THE

NORTHERN MICROSCOPIST.

AN ILLUSTRATED JOURNAL OF

PRACTICAL MICROSCOPY.

EDITED BY

GEORGE E. DAVIS,

F.R.M.S., F.C.S., F.I.C.,

ETC., ETC.

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THE NORTHERN MICROSCOPIST.

LIST OF ILLUSTRATIONS.

PREFACE.

THE completion of our first volume gives us a suitable opportunity of thanking our readers for the kind support they have given to our little venture.

When we cast our eyes about us and see the vast strides that Microscopy is making, when we consider the important part it is playing in the different departments of Science, and how extensive is its application in the arts and manufactures, we must be at once struck by the paucity of journalistic literature devoted to a practical handling of the subject.

It was in a measure to supply this want that the Northern Microscopist was brought into existence, and to this, too, doubtless, is largely owing the fact that it has at once found its way to so many book-shelves.

Very many—we might almost say most—of our large towns have their own Microscopical Societies, but it has not been found possible for such to publish separately their own proceedings. We have to a certain extent enabled the Societies in our Northern towns to possess a complete record of their meetings, while many of the papers read at them have been printed without abridgement, and have, at a considerable expense, been illustrated, whenever it appeared that such a proceeding was necessary to secure their due appreciation.

It has been our aim to supply the reader with articles of a practical nature, and we are glad to find that they have met with a favourable reception. The chapters introducing the study of Fungi and of Lichens, the monthly articles on Micro-Fungi and Leaf-

Fungi, on Double-Staining, Photo-Micrography, and Section-Cutting, have been highly valued as is shewn by the testimony of many who have written us to that effect.

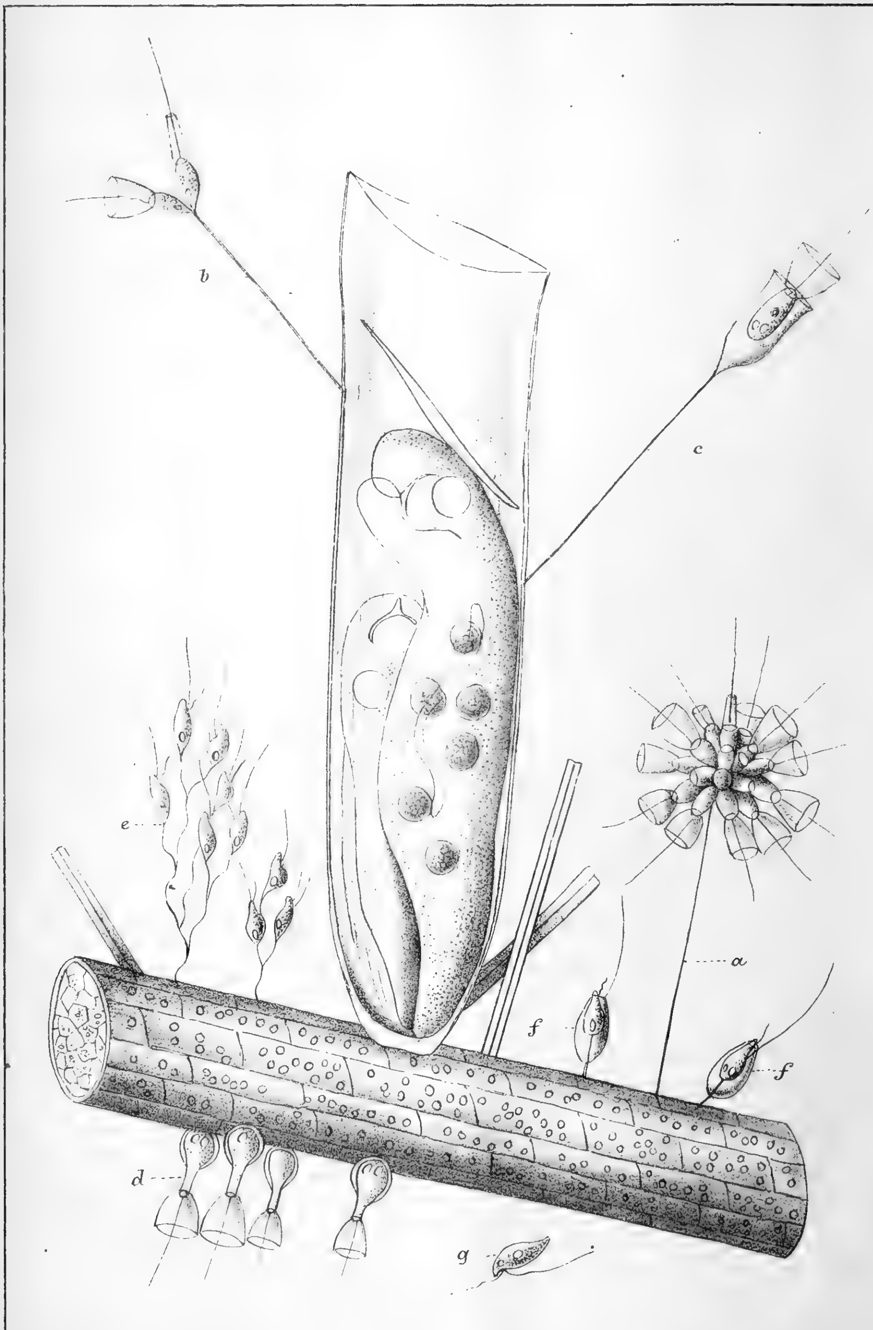
A wish has been also expressed that we should give abstracts of Articles from Foreign Journals: we would willingly do this if space allowed, but would remind our readers that the improvements we have in view must depend upon our Subscription List.

The Exchange Column for slides and raw material we would like to see more frequently used than at present, as it is almost the only method by which exchanges between strangers can be effected, and there is little doubt that if communications of this kind were more frequent between persons at a distance from one another, it would conduce to a better style of mounting than at present exists among amateurs, and tend to a wider circulation of new ideas and improvements in this respect.

Our Verification Department has been a most decided success. When the idea was first suggested to us, we were much opposed to it, being of opinion that Microscopists would not care to have their objectives "verified." The number of lenses sent into this Department has proved to us the fallacy of our supposition, and this portion of our pages promises to become one of the most interesting.

In conclusion, we congratulate ourselves upon having collected and put upon record much valuable matter that would otherwise have remained in obscurity: we thank our subscribers for aiding us in attaining to this end, and heartily wish them

THE COMPLIMENTS OF THE SEASON.



W. Saville Kent del.

West, Newman & Co. lith.

THE NORTHERN MICROSCOPIST.

No. 1. JANUARY. 1881.

TO OUR READERS.

THE commencement of a new year is, perhaps, an appropriate time for launching a new venture, as at this period mankind generally is making all manner of resolves and promises, and being in a most unsettled state is apt to fix upon anything new and settling down to rest with it, gives it a trial.

In issuing THE NORTHERN MICROSCOPIST we have every reason to hope for success, seeing that its aim is to keep a record of the proceedings of the chief Microscopical Societies in the North, and so furnish the individual member with at least as much permanent information as he would obtain if the Society to which he belonged published its own transactions—may be more.

Since sending out our prospectus we have received numerous congratulatory letters, assuring us of support, and we have much pleasure in testifying to the good-will which appears to exist amongst microscopists generally, as evidenced by the results of our preliminary correspondence.

Many microscopists have written us setting forth the absolute need of a journal such as this.

We should only be wasting time and space if we entered into a lengthy dissertation as to what we proposed to do in future numbers. No. 1 is a type of what is to follow; but in sending it forth into the world we are conscious that it may admit of improvement, and

therefore the advice, opinions, and suggestions of our correspondents will not be allowed to fall on deaf ears.

We hope the establishment of THE NORTHERN MICROSCOPIST will be a bond of union between workers in the North, and that it will bring to the fore many men whose researches have scarcely been heard of on account of their distance from the great Microscopical centres.

It is but too true that in the North many hard working microscopists living but a few miles apart have scarcely known of each other's existence though working perhaps on the same subject, and therefore have never had the opportunity of extending the hand of friendship or of mutually assisting in their researches.

One thing has rather surprised us—that in several towns of considerable magnitude, there is no Microscopical Society in existence. We cannot but feel that the want of a journal such as this has militated against the permanence of many societies, till at length Microscopy has found itself absorbed as a dependency of some Natural History Society which has come to its aid, or if such a society has not been in existence Microscopy has died out altogether.

We have at much trouble, and not without some difficulty, endeavoured to form a fair list of the Microscopical Societies in the North, as well as of those, Literary and Philosophical, and of Natural History, where Microscopy forms a section. We are aware that this list must be incomplete, and cordially invite Secretaries of all societies interested in a journal of this kind to send us data for our Diary as well as a report of their proceedings.

We shall be glad to correspond with microscopists who may read papers before the various Northern Societies, with a view to their publication, either *in extenso* or as abstracts; our desire being to extend the study of Microscopy.

A PIECE OF WEED AND SOMETHING ON IT.

Plate I.

AT any season of the year the working microscopist is seldom at a loss to find suitable hunting ground; but perhaps of all places more frequently visited than others, are the banks of ditches and ponds, and wet or boggy tracts of country.

Let us betake ourselves to the ditch side, and there, no doubt, we shall find a plentiful supply of a rather common weed, the *Myriophyllum spicatum.* This weed, or rather aquatic herb, belongs to the natural order Halorageæ: it is a member of the Mare's-tail family.

The student may think, perhaps, that because the weed is a common one it should be passed by, as affording nothing for observation of interest; but such notions must not be tolerated for a moment when dealing with such widely-spread organisms as Infusoria, for all weeds, however common, are generally found encrusted with many different and often rare species. *Anacharis alsinastrum* is a still more abundant weed than the *Myriophyllum*, and this we have often found with a host of organised appendages, *Acineta*, *Vaginicola*, *Vorticellæ*, *Cristatella*, and others.

But to return to the *Myriophyllum spicatum*—Mr. Bolton sent us a few weeks ago a piece of this weed encrusted with many different species of Infusoria, besides which were many species of Desmids and Diatoms with various filamentous confervoid algæ, which entangled the former in their convolutions. The Desmid *Pediastrum granulatum* appeared remarkably perfect when, after a little difficulty, we managed to isolate it from its surroundings.

The more interesting organisms, however, were the genera of Mr. Saville Kent's newly established order of the Choano-Flagellata represented by the species *Codosiga botrytis* and *Salpingœca amphoridium.* Mr. Saville Kent has sent us the drawing which forms Plate I., and which was executed from a piece of *Myriophyllum* derived from a similar source.

The largest central figure is a representation of *Vaginicola valvata*, a species of the family Vorticellidæ of the class Ciliata: the body is sessile, and is contained in a sessile urceolate membranous sheath, furnished internally with a valve-like operculum which closes down and protects the animalcules from molestation when in their contracted state, as indicated in the figure. At A is to be seen *Codosiga botrytis* under an amplification of about 700 diameters—that is to say, in order to arrive at the same magnification the observer must use his quarter-inch objective with the D eye-

piece, or his one-eighth inch with the C. Considerable skill and patience is required in order to produce that illumination which will show the funnel-shaped structure, or "collars," which surmount them, to the best advantage; oblique illumination will invariably show form and structure which cannot be made out by the simple use of direct light.

The genus *Codosiga* has been well studied by Mr. Saville Kent. The method of reproduction is simple, some zooids multiplying by longitudinal fission, while others protrude digitiform pseudopodia from all parts of their surface, become encysted, lose their membranous collars and flagella, becoming finally sporocysts or egg chambers. The organism represented at B is an early growth of the same species.

The figure at C represents *Salpingœca Boltoni*, a new species, here figured for the first time, and D is the *Salpingœca amphoridium*, which we have often seen growing also on *Anacharis alsinastrum*. The life history of this organism, as traced by Mr. Saville Kent, is of a most interesting character, showing, as it does, the retraction of the membranous collar within its lorica, its internal encystment, the amœboid condition of the sarcode, and the final detachment of the amœba-like body from its case.

The organism which is delineated at E is the *Cladonema laxa*, S. K. a newly discovered species of the order Flagellata-Pantostomata and family Dendromonadidæ. The sketch shows a colony, as irregular pyriform bodies attached separately to the extremities of irregularly and dichotomously branched non-rigid thread-like pedicles. The colonies vary in number from three or four to as many as twenty or more zooids; the endoplast is usually conspicuous, as well as one or more contractile vesicles, no distinct oral aperture is visible, the food being incepted at all parts of the periphery.

Bicosœca lacustris, belonging to the same order as *Cladonema*, but of the family Bikœcidæ, is figured at F. In this genus the organisms are solitary, inhabiting simple pedicellate horny loricæ, to the bottom of which they are attached by a contractile ligament or peduncle. The members of this genus were first described by Professor James Clark, and were then figured as possessing a single flagellum only. It is now shown by Mr. Kent to be furnished with two distinct appendages, one long and the other short, the former when retracted being rolled spirally within the cavity of the lorica. Generally the multiplication of *Bicosœca lacustris* takes place by transverse fission, but it is also found encysted, the contents of the lorica appearing to be filled with spore-like bodies as in *Codosiga botrytis*.

We conclude this description of our plate by drawing attention to figure G, representing *Heteronema caudata*, belonging to the

family Anisonemidæ and order Flagellata-Enstostomata; but as we fear the foregoing description can hardly do justice to Mr. Kent's sketch, we refer our readers to the "Manual of the Infusoria," which they will find reviewed in the following pages.

LEAF FUNGI.

By Rev. J. E. Vize, M.A., F.R.M.S., etc.

FUNGI attack leaves of all kinds; or, to put it in another way, leaves of all kinds are liable to invite fungi to grow on them. It matters not whether the leaf be alive, and to external appearances quite healthy, or not; whether it be beginning to decay, or has already gone a considerable step towards death; whether the leaf has lost every atom of vitality, fungi are ready to grow just where they find the exactly suitable place for their spores to germinate. You may, if you like, examine the leaves of the earliest plants of spring, even before the severity of winter has passed, and you will find them covered with pustules of fungi. Take, as an instance, the *Æcidium violæ* (Schum) and the *Æc. ranunculacearum* (D.C.), both of them good examples of the cluster cups; with a common pocket lens they may be examined, and they show an amount of beauty rarely surpassed. And then, as the snow of winter dissolves, and the days lengthen towards summer, you get a constant succession of leaf fungi. They live on the hedge bank, the canal side, the turnpike road, the sides of the waterfall, the edge of the mountain, the thickets of the wood. Sometimes they prefer shelter from the bleak and cutting winds; at others you will find them on spots which are quite exposed. Occasionally they may be seen in the bottom of ditches partly dried. Go where you will, if you have an eye for leaf fungi, you will be tolerably sure to meet with them, unless you get into houses in the city, and even they are not absolutely free; the gardens attached to them are very apt to produce leaf fungi. Some have a special aptitude for green and hot houses. Moreover, there are some fungi, such as the *Mitrula paludosa* (Fr), which luxuriate only in leaves, such as those of oak fallen from the parent trees, quite dead, but immersed in stagnant and other times running water. The cryptogamic botanist who wants to get leaf fungi may always find them by taking a stroll in the country. Furnished with very few tools, he may make sure if he be a young beginner that his attempts at discovering some leaves with fungi on them will soon be rewarded; and if he has passed through the first stages of mycology he will soon recognise in his walks forms of fungi on leaves which are as old friends to him,

because he has through examination been brought into close study with them. With few exceptions, such as certain agarics, which grow only on leaves in process of decay, there is one thing which has a tendency to make the study of leaf fungi not so popular as that of larger fungi. It is this: they cannot be determined without the help of a microscope. There is a similarity in the external appearance of many leaf fungi. That man must have a very microscopical eye who would venture to say off-hand whether a certain fungus growing on grass were *Puccinia graminis* (Pers), *Puc. coronata* (Corda), or *Dothidea graminis* (Fr); but put them under a microscope and you at once know the three things just mentioned to be as distinct from each other as a roll of sausages, a cottage loaf, and a cottage loaf with a crown on it. The fact is, one of these forms is ascigerous, that is to say contains its spores in an ascus or transparent bag, the other two bear the fruit without any external case after the young stage. The microscope often costs a considerable outlay; its manipulation is not comprehensible at a glance. Connected with the examination of microscopical fungi much more trouble is necessary than merely taking an eye scrutiny of a good sized fungus, and so deciding its proper place and name in mycology. Nevertheless the extra care needed, and labour expended, amply repay the student where time is not an essential desideratum. You get in the microscopical forms of fungi some of the most beautiful colours and shapes you can possibly wish to have. For scarlet vermilion you cannot anywhere surpass the *Lecythea rosæ* (Lev), for intense black the *Phragmidia* are good examples, so also the ripened *Xenodochus carbonarius* (Schl). The leaf fungi certainly are beautiful contrasts as regards colour to the natural green of the living leaf on which they happen to grow, and often to the tint of the dead leaf. Then as regards shape, what is more graceful than the form of some of the ascigerous plants? The *Erysiphei* with their appendages springing from their central body are nothing short of magnificent. The *Sphæriacei* are also grand, amongst others *Sph. herbarum* growing on the peas, *var. pisi* as it is called, &c. Then look at the *Sph. coryli* (Batsch). Even to the unassisted eye the shapes are good. So also is its ally, *Sphæria fimbriata* (Pers). Amongst the non-ascigerous particularly may be noted when magnified, the *Puccinia malvacearum* (Corda) *P. chrysosplenii* (Grev) *Æcidium urticæ* (D. C.). The more sturdy shapes are shown in *Puc. vincæ* (B.) *Puc. prunorum* (Link) *Puc. umbilici* (Guep). The aculeate forms we get in specimens not British, *Puccinia aculeata*, *Puc. Linkii*, *Puc. Prostii.* Nor should the Mucedines be forgotten. *Penicillium roseum* is graceful indeed with numbers of its allies. The *Peronospora* genus also. These show an amount of elegance worth the study, worth the cost, worth the trouble many times repeated, of the enthusiastic admirer.

But look at the leaf fungi as useful from the interest they give—a point you will say common to a certain extent with all other scientific pursuits. You need not go a walk at any season of the year when there will not be within a few yards of your door, if you live in the country, some leaves that you may put in your pocket-book or botanical case to examine when you get home. Here is a decided advantage in having an out-of-door pursuit when accompanied by scientific investigations. You get at once an object in your exercise in the fresh air. There is a definite thing to be done, and with it the powers of the mind are called into exercise, and the identical walk which to him who cares for none of the various "ologies" is stale and torpid, becomes to him who follows science from the love of it, a healthy, invigorating, and very often highly spiritual exercise. The body gets healthy exercise and the mind is actively employed. There is another useful thing obtained by these and kindred sciences. They encourage a feeling of brotherhood amongst spirits of the same type. The clans of labour, of trade, of the professions, of the titled aristocracy are broken; the distances between man and man are shortened. You are willing to receive me, I am willing to receive you without much more introduction, whatever our grade in life, than that we both of us like to investigate God's work in the humble but none the less beautiful forms of cryptogamic botany; we both feel that there is a common union between us made perhaps in a leaf fungus or whatever else we may both of us like to examine. A few more words, and I must stop. Leaf fungi are not only interesting in the point to which reference has been made; we believe they are of vital *chemical* importance. When are our nostrils more keenly alive to decomposing vegetable matter than when we have against the laws of nature put our leaves to rot in a way whereby they cannot be attacked by fungi. Get your fresh laurel leaves, put them into water for a few days, and the smell will be pestilential; but let them fall on the ground and decay in their usual manner. What happens? You get the *Trochila lauro-cerasi* (Fr) *Sphæria ceuthosporoides* (Berk) *Diplodia tecta* (B. and Br.) *D. consors* (B. and Br.) you may find *Ceuthospora lauri* (Grev) and *Stemonitis arcyrioides* (Somm) all hastening to rescue the air from the seeds of illness, and all finding in the dying and dead leaf just that exact spot where it can brighten out its existence the period appointed for it, and where in smallness of size, it can vie with the oak of the forest as regards the splendour of its proportions, minute though they are, ramifying its mycelium through the decaying parts of the leaf, and so turning to good use those very chemical properties essential to it which otherwise would be so deadly to us and ours. To sum up, we say leaf fungi are useful as aids in the chemical destruction of gases very injurious to us; they are useful and interesting in promoting friendships;

they enhance considerably the pleasures and study of a country walk by giving us a fixed object in our walk; they are splendid as a study on account of their beauty of colour and variety of form; they are parasitic on living, dying, and dead leaves, and therefore obtainable all through the year.

THE EXAMINATION AND PRESERVATION OF INFUSORIA.

WITH the lower powers of the microscope scarcely any instructions are needed for the observation of Infusoria, but as many of them require the use of high powers, a few remarks showing how to proceed in such cases may not be out of place, but rather of assistance to the student.

Infusoria are generally attached, sometimes to leaves and stems of aquatic herbs, at others to the fronds of algæ, while not a few are to be met with encrusting floating bodies such as pieces of stick and straw, or even upon the shells or carapaces of the Crustacea.

Some of these large opaque bodies, or rather the organisms upon them, are exceedingly difficult to view with high powers, such as the one-eighth, but if the object be laid upon a slide and a thin glass cover placed on the spot to be examined, a little water being added under the cover with a curved pipette, capillary attraction will often retain sufficient to enable the observer to examine the object without much difficulty. The value of immersion objectives is here set forth, as in this case it is only necessary to immerse the object in a shallow stage trough, and focus into the water upon the object sought.

The organisms upon stems of water plants, or on other cylindrical bodies, are examined without so much difficulty: a piece snipped off with the scissors may be laid upon a slide and covered with thin glass, and by having a film of water between the two, the examination is easily performed, even with high powers. It may happen that the stem or other host is too thick, and therefore sections will have to be made of it; but this is a very easy operation with an ordinary scalpel, and the assistance of a watchmaker's or engraver's eye-glass.

Leaves are more difficult of examination, the best objects are sure to be situated in a plane at right angles to that of the leaf, so that a live box is of but little use unless the characteristic part of the organism is near the edge.

A small portion of leaf, with the organism upon it, may be comfortably examined on a glass slip and covered with a thin film of talc, but for most of these organisms the immersion lenses seem preferable when high powers are required.

When the organisms are found on *Myriophyllum* or *Anacharis* they cannot be better exhibited than by taking a single leaf, placing it on a slip of glass, provided with a ledge, with a little water, cutting off every portion of the leaf which might interfere with the examination, and then covering with thin glass or talc. In this way they can be viewed with high powers, and beautifully illuminated with either spot-lens, paraboloid, or Webster's condenser.

In any investigations, where it is desired to retain the same organism for any length of time, a moist chamber must be improvised, such as that constructed by Messrs. Dallinger and Drysdale, in their experiments on the Life History of Monads, and figured in the Monthly Microscopical Journal for March, 1874.

Another moist chamber which has the merit of simplicity is Weber's convex cell. This consists of a glass slide 3 inches × 1 inch, in which is ground a shallow well having a convex lower surface. The organisms contained in a drop or two of water are to be placed in the centre of the cell, and covered over with a thin covering glass, afterwards being ringed with oil, brown varnish, or any other substance of a similar nature. Evaporation is hereby prevented, and if care has been taken to place the organisms upon the extreme summit of the convexity, they may be examined with the highest powers.

During the observation of many of the Infusoria, some tissues and appendages are unseen, on account of their transparency or rapid motion; errors of observation induced by this latter cause may generally be obviated by killing the organism with osmic acid, and the former by adding a solution of some colouring matter, of which methyl green, Bismark brown, carmine, picric acid, and magenta are the most useful. Iodide of potassium solution, saturated with iodine, is also very generally applicable. Osmic acid is usually applied in a one or two per cent. solution, and the best method of using it, is to place a drop of this upon the underside of the cover glass before lowering it upon the slide where the organisms have been placed.

As to the preservation of Infusoria, many methods have been devised, which have not stood the test of time. Mr. Saville Kent states, in Part I. of his Manual, that they may be sealed up after treatment with osmic acid without the addition of any other preservative, and that it will be found, the smaller and most delicate flagelliferous species are equally amenable to this treatment, preserving their flagella, and even in the case of the Choana-Flagellata, their sarcode collars in a life-like form.

OUR BOOK SHELF.

A Manual of the Infusoria. W. SAVILLE KENT, F.L.S., F.Z.S., F.R.M.S. London: David Bogue. 1880. Part I., 144 pp., 9 plates, including frontispiece. Part II., 144—288 pp., and 8 plates.

THIS long looked for work has at length made its appearance, and we think its contents and general style will have satisfied all subscribers. Two parts out of the six have been issued, and the remainder announced to appear monthly till the work is completed, and if the same care is bestowed upon the succeeding parts as upon the first two, we have no hesitation in styling it a book which no microscopist's library should be without.

The contents of the first part reach four chapters, the first of which is introductory, and gives a general history of Infusoria from the time of their discovery by Leeuwenhoek in 1675 up to the present day. This chapter is exceedingly interesting, showing as it does how our discoveries may be looked upon two hundred years hence. Ehrenberg's work is noticed at some length, and mention is made of the numerous errors propagated by that observer.

There are several works which have been published on this subject, but all are now out of date, and the most recent of them, viz., "Pritchard's History of the Infusoria," which was published in 1834 (the fourth edition appearing in 1861), was chiefly a compilation of the work of others, and contained accounts of organisms, which must certainly now be expunged from the list of true Infusoria.

Chapter II. treats of "the Sub-kingdom Protozoa," and on p. 36 is given in a tabular form the sections, classes, orders, families, and typical genera of this sub-kingdom. Chapter III. is a dissertation on the nature and organization of the Infusoria which the student will do well to study carefully. The information contained in this chapter is worth the price charged for the whole part, and in order to make this clear we give the sub-headings, which show that the care taken by the author to make his work complete has been of no mean character: Cuticular elements or Ectoplasm—Internal elements or Endoplasm—Excreted elements—Encystment—Locomotive and prehensile appendages—Oral apertures or Cystostomata—Anal apertures or Cytopyge—Contractile vacuole or vesicle—Nucleus or Endoplast—Nucleolus or Endoplastule—Coloring matters—Accessory structures—Amylaceous corpuscles—

Decomposition or Diffluence—Reproductive Phenomena, Binary division or fission—External and Internal Gemmation—Sporular multiplicities—Sexual or Genetic reproduction—Affinities of the Infusoria to the higher Zoological groups—Distribution of the Infusoria—Preservation of the Infusoria—winding up with the Methods of Investigation.

Amongst the above is to be found a careful account of the coloring matter of these organisms, including the bright red corpuscles of *Euglena*, described by Ehrenberg as optic organs, with mention of Professor E. Ray Lankester's researches upon the spectroscopic appearance of these tinctorial substances.

The fourth chapter on Spontaneous Generation is exceedingly well put together; the masterly researches of Messrs. Dallinger and Drysdale, of Liverpool, are detailed at some length with those also of Professor Tyndall, and it would be well if all those who hold similar views with Dr. Bastian would read in this treatise how that the germs of *Cercomonas typica*, *Heteromita rostrata*, with those of other species, "when first released by rupture of the enclosing cyst are of such extreme minuteness as to defy individual resolution with the one-fiftieth inch objective and associated magnifying power of no less than 15,000 diameters."

A glance at Plate XI. in Part II., and reference to p. 41 in Part I, brings us to debatable ground—we refer to the position accorded to Myxomycetes, and here termed Mycetozoa. This fungal division may be studied to the best advantage in Sach's Handbook of Botany issued by the Clarendon Press, and we are bound to confess that pages of matter which tell us that those bodies we have so long regarded as fungi, such as *Didymium Trichia*, *Stemonitis*, *Arcyria* and *Physarum* require much inception ere we can bring our minds to believe them animals, for the reason that at one period of their existence they produce moving or zoospores.

The difficulty of separating Protophytes from Protozoa by a clear line of demarcation is still as great a task as ever, and the simple transfer of a family from one side to the other does not settle the question. We cannot say there is any natural boundary, at least at present, and an artificial one must needs be open to human error. It must not be forgotten that Dr. De Bary (partly upon whose evidence it is, that the Myxomycetes have been transferred to the Protozoa) was once caught tripping with regard to the resting spores of *Peronospora*—might it not be that his visual organs have been deceived in this instance also.

NOTICES OF MEETINGS.

BOLTON MICROSCOPICAL SOCIETY.—On Nov. 19th, the third annual Conversazione of this Society was held in the Albert Hall under most auspicious and promising circumstances. Formed with the object of fostering a love for research, it has achieved for itself within a comparatively short period a position as one of the foremost provincial societies. The exhibition was in every sense superior to its predecessors, and reflected infinite credit upon all who had contributed to it. The tables, about 20 in number, were neatly arranged, and were embellished with a number of handsome flowering plants, palms, and ferns, kindly lent for the occasion by the Mayor, John Musgrave, Esq., and John Harwood, Esq., of Wood Leigh, and these gave a very charming appearance to the Hall.

During the evening the Borough Organist played with much ability a choice selection of music upon the organ; and strewed over tables about the Hall were many objects of interest which, though not strictly microscopical, served to occupy the time of those who could not get immediate glances at the microscopes. As to microscope stands and objectives, nearly all the leading makers in this country were well represented. Messrs. Ross and Co., Smith and Beck, Messrs. R. and J. Beck, Messrs Swift and Son, Crouch, Baker, Dancer, Parkes and Banks Bros., of Corporation Street, Bolton, all seemed to have found purchasers in the members of this Society. Nor must we forget the instrument belonging to the President, C. L. Jackson, Esq., F.R.M.S., and made by Messrs. Powell and Lealand, who also exhibited one of Pritchard's microscopes made in 1830. There was also exhibited a microscope date 1780, and supposed to be one of the best instruments manufactured at that period.

The objects exhibited upon these stands were full of interest; upon a central table were many microscopes devoted to the subject of Pond Life, the two most interesting studies being *Volvox globator* and *Stephanocerus Eichornii* by dark ground illumination. This table was personally superintended by Mr. T. Bolton of 57, Newhall Street, Birmingham.

The table possessing a feature of melancholy interest was that covered with the microscopes and rich work of the late Dr. Redmayne, one of the founders of this Society. The presence of his photo-micrographs, the varied assortment of pathological preparations and rare diatoms made it hard to believe that he was not present also. Other objects of unusual interest were:—Marine algæ, palate of cuttle fish, section of injected human kidney, ovary of cat, and, above all, the parasites of flukey liver and measled pork, shown by Mr. E. Sargeant, the Medical Officer of Health; the human muscle with encysted trichinæ, by Mr. William Rideout, the Hon. Sec. The exhibitors were Messrs. Midgley, Heaton, Sergeant, Banks Bros., Pennington, Kenyon, Whalley, Thompson, Walmsley, Hart, Best, Harwood, the President C. L. Jackson, Esq., F.R.M.S., the Hon. Sec., Mr. W. Rideout, and others.

At 7-30 p,m., the Hon. Sec. read the following report:—

Another year having elapsed, I have great pleasure in reviewing the work of the Society during that period. The Society's year commences on October the 1st, lectures and other work occupying the members until the month of May, when the Society virtually closes until the month of September. This recess is found to be useful in more ways than one. It allows members an opportunity for microscopical research during the summer months in the open country, which at that season teems with interesting objects. The attendance at the meetings are not interfered with by holiday making, and after a certain amount of relaxation the members work with renewed vigour. Nine general meetings of the Society have been held during the session on the following dates: October 4, October 31, November 7, January 16, February 6, March 5, April 23, May 14, and September 3rd. Six Committee meetings have been held in connection with

the Society. Lectures bave been given on three occasions on the following subjects connected with microscopical work : January 16, on "Pollen and the fertilisation of flowers," by Mr. W. W. Midgley ; March 5, on "Some forms of microscopic fungi," by myself; April 23, on "The microscopic examination of mollusca, with special reference to the palate," by Mr. Jackson. A conversazione was held in the Albert Hall, Bolton, on the evening of Friday, November 21st, (1879) which was well attended, and gave general satisfaction ; but which did not materially improve the financial position of the Society owing to the expenses incurred in its preparation. The total number of members on the books of the Society during the year was 50. We have now in the Society, members and associates, the associates being elected members when they become possessed of microscopes. This arrangement has been found to work extremely well, as it allows a novice to pick up information respecting microscopical work, and to obtain the best information respecting the purchase of an instrument. The Society is in a sound position financially, having a good balance in hand, besides a considerable number of articles necessary for the working of the Society, which have been obtained from time to time, as necessity required. The Society possesses a good collection of mounted objects, and a handsome cabinet, owing to the generosity of one of our members, Mr. Slater, of Dunscar. I cannot close my review of the work of the Society without referring to the great loss which we, as a Society, have sustained by the long illness and death of our talented and much-lamented treasurer, Dr. Redmayne. During the whole time since the formation of the Society he had its well-being at heart, and few knew better than myself how deeply he regretted that he was prevented from assisting in the work of the Society by his failing health. I am sure that each member of the Society felt that he had lost a dear friend when he heard that the doctor was no more. His pleasant smile and genial manner will long be remembered by us, and failing this his name will live as the founder of the Bolton Microscopical Society. This reminds me that another who was present at our last conversazione has passed away. I refer to S. M. Bradley, Esq., the talented lecturer, who described in such glowing terms the beauties which lie hidden in a pool of sea water. In conclusion, I would say that the Society is firmly established on a substantial basis, and as an educational means is doing much to foster a love of nature and to provide healthy recreation for leisure hours. Much has been done, but more may be done, and it rests with each member of the Society to use his utmost endeavours to sustain and increase its reputation in the wide field of action and usefulness that has been opened out.

The President then delivered his address which was listened to with much interest, but which owing to want of space we can only give in abstract. He said : Ladies and Gentlemen,—It is my pleasing duty once again on behalf of the Bolton Microscopical Society, to welcome our friends who have come to spend an evening, peeping into our mysterious and, to the unaided eye, unseen world. It is difficult to believe that since we last met a whole year has passed away, and the thought is tinged with sadness as we recall the memory of those who added so much to our evening's enjoyment twelve months since. Last year we had a grand display of curious forms of life contributed from our ordinary world by the Directors of the Southport Aquarium. This year, under the direction of Mr. Bolton and Mr. Shipperbottom, we have drawn from our unseen world creatures more grotesque, more singular, and perhaps some of them more beautiful than anything we had here then. As we examine them, our interest is first attracted by their appearance, is then riveted by their singular habits, and as we study them more closely, we become perfectly entranced with wonder and admiration at the skill displayed in adapting them to their positions in life, and arming them against its dangers. Some of them we find have two or three distinct methods of increase to suit the different positions in which they find themselves. Others are capable of being dried up for years,

and yet awaking like the seven sleepers at the first touch of water. I possess a slide, mounted some dozen years ago, on which there are hundreds of wheel animalcules. These have been repeatedly dried up for weeks or months, and yet each time they are revived by the application of water they seem better and happier than the last time. Others undergo changes beside which "Alice in Wonderland" becomes common-place; so singular are some of these that unless they had been patiently watched, and worked out, by reliable observers, even those accustomed to the wonders of nature would reject them as travellers' tales. The vegetable world is quite as interesting as the animal. Some people have an idea that microscopy is an expensive hobby. It is quite a mistake. One may certainly revel in the luxury of costly instruments; but a very good microscope can be got for a moderate sum, which, once paid, you have a never-ending source of amusement and interest. With a magic lantern you must necessarily get fresh and costly slides, with a stereoscope the same; but with a microscope everything around you furnishes interesting objects; and if you don't care to spend money on glass beakers, boiling tubes, &c., a little skill in foraging in the kitchen when cook is out of the way will go a long way to supply your wants in that respect. Cups and saucers, tumblers and wine glasses, are capital substitutes, and a heap of old shrimp and Liebig pots is a perfect treasure. If you want something to start on, try the week's groceries. It may make your grocer a little uncomfortable to know that his wares are being so closely scrutinised; but never mind him. If all is right you will find a vast fund of interest; and if you *should* find something you did not buy, you will have gained some material, as well as mental good, for he won't try pranks on you again in a hurry when you tell him of his misdeeds. I need not now go more into detail. The abler skill of Professor Williamson will take in hand and work out more elaborately one special branch of study which I have touched upon.

The company then retired to the Borough Court, where Prof. Williamson, of Owens College, Manchester, delivered a lecture on "Mosses and Ferns."

The President having briefly introduced the Lecturer,

Professor Williamson said the Committee had selected a subject which certainly bore very closely and very accurately upon the object which brought them together in the first instance; he meant microscopic research and the study of the natural sciences. He put microscopic research in the foremost place, because judging from the address, a portion of which he heard their President deliver, he took it for granted that microscopic research was one of the great objects that the Society had in view. Proceeding to deal with the subject of his lecture, the Professor pointed out the modes by which mosses and ferns multiplied themselves, and he dwelt particularly upon the statement that the investigations of the last half-century had made them familiar with the fact that there was a peculiar process in nature by which the blending of two minute protoplasmic atoms, not exhibiting many differences, in many cases really indicating no differences at all, formed a third element endowed with marvellous power. The Lecturer then proceeded by means of diagrams to illustrate at some length the whole history of the fern from its embryo state to its full development, showing the different modes by which it was reproduced. He also followed the same course with reference to the mosses, remarking that mosses stand out pre-eminently in the law of nature for their endless reproduction.

At the close of the lecture, a vote of thanks was moved by the Mayor, John Musgrave, Esq., and seconded by J. R. Cross, Esq., M.P., and carried with acclamation.

DONCASTER MICROSCOPICAL SOCIETY.—The present session of this Society was opened on October 6th, by a very successful Conversazione, at which nearly 300 ladies and gentlemen were present. The programme for the year shows that the meetings will be of a very interesting character. The following papers are announced:—Notes on Mounting, Mr. M. H. Stiles; Germs,

Mr. J. Mitchell Wilson, M.A.; Foraminifera, Mr. F. Milner; Lower Forms of Animal Life, Mr. J. M. Kirk; The Structure of the Blow-fly, Mr. W. Roberts; Cellular tissue of Plants, Rev. W. Smith, M.A.; The Preparation and Staining of Wood sections, Mr. M. H. Stiles; on the Embryonic Metamorphosis of the Cirrhipeda, by Mr. J. B. Withington, M.R.C.S., President.

LIVERPOOL MICROSCOPICAL SOCIETY.—The eighth ordinary Meeting of the twelfth Session of this Society was held at the Royal Institution on Friday evening, Nov. 5th, Dr. Hicks, F.R.M.S., President, in the chair. The Hon. Secretary, Mr. I. C. Thompson, F.R.M.S., announced the donation of six slides of marine algæ from Mr. Grattann, of Torquay, honorary member. Mr. W. A. M'Murtrie and Mr. F. B. Allan were elected ordinary members. The Rev. William Banister read a communication he had received from Mr. G. E. Massee, of Scarborough, on "Fungi of the order Myxomycetes." Mr. Massee succeeded in growing spores of *Spumaria alba*, and found that threads of different kinds appear on two or three points of the surface of the spore. One kind is of a mycelioid character; the other consists of oval cells multiplying by gemmation until a torula-like chain is formed, which divides; becoming nucleated, each cell increasing rapidly in size and remaining as a resting spore for nearly a year, and not taking any amœba-like form. After this some immature *Spumaria* appeared in a pulpy homogeneous mass, in which were numerous bright specks, each being a focus round which the plasma formed naked cells of amœboid character, or plasmodium. After three days all movement ceased; the cells assumed a spherical shape, bright nuclei appeared, and within twenty-four hours the cell wall was absorbed and the mature spirulose spores set free. The paper of the evening was read by F. T. Paul, Esq., F.R.C.S., on "The Structure, Growth, and Development of Bone." The author introduced the subject with a short sketch of the comparative anatomy of the skeleton, alluding to the supporting framework of the lowest forms of life, the calcareous and horny exoskeletons of intermediate forms, and the cartilaginous, dentinal, and osseous endo-skeletons of the vertibrata. A minute description was given of the microscopical character of bone, showing it to consist of layers of hardened fibres and bone cells arranged in peculiar concentric circles, called Havarsian systems. Blood vessels occurred at intervals, but the nourishing fluid was brought into intimate contact with the tissue by means of the bone cells. Bone was classed as a connective tissue, and its origin was traced from the first appearance of this tissue in the embryo to the formation of membrane on one hand and cartilage on the other. Ossification in membrane and ossification in cartilage were then separately described. Following this was the process of growth, which varied in different bones. The paper was freely illustrated by diagrams and microscopic specimens. At the close, on the motion of Dr. Carter, a hearty vote of thanks was accorded to Mr. Paul. The meeting concluded with the usual conversazione and microscopical exhibition.

MANCHESTER CRYPTOGAMIC SOCIETY.—The usual monthly meeting of this Society was held on November 13th, Dr. Carrington the President occupying the chair. A donation of a number of specimens of Sphagnaceæ or bog-mosses was announced, from Dr. Braithwaite, being a continuation of a series which he had formerly presented to the Society. Mr. Robertson of Glasgow sent a packet of the moss *Bryum roseum* in fruit, which he had culled from the island of Cumbrae. This species is often met with in the Manchester district, but has not probably been observed in fruit since the finding it in that condition by the late Mr. E. Hobson near Hale Barns. Mr. W. H. Pearson exhibited a species of Jungermannia new to Britain, the *Jungermannia socia*, which he had found upon Cader Idris. The annual report was read by the Hon. Sec. and was unanimously adopted. Votes of thanks were passed to the contributors and to the officers of the Lower Mosley Street Natural History Society, for the use of their room.

MANCHESTER MICROSCOPICAL SOCIETY.—On Thursday, Nov. 18th, after the formal business of the meeting was finished, Mr. John Boyd exhibited some camera lucida drawings of *Vaginicola valvata;* the long posterior-spine *Daphnia Schœfferi*, and also of *Chydorus sphœricus*, all of which he had taken in Derwentwater. A letter was read from Mr. Thomas Brittain, saying that he had just returned from a sojourn in the Lake district with numerous specimens, and that he would be happy to place three evenings at the disposal of any members of the Society who chose to call upon him.

Mr. George E. Davis, F.R.M.S., distributed numerous specimens of *Chydorus sphœricus*, and also made a statement referring to the publication of THE NORTHERN MICROSCOPIST.

The paper for the evening was read by Mr. A. W. Duncan, upon Coffee and its adulterations. Mr. Duncan commenced by giving a botanical description of the coffee tree *(Coffea Arabica)* which he stated was of the natural order Cinchonaceæ. The tree came to full bearing in three years, and under favourable circumstances will continue bearing for twenty years or more. The flowers grow close to the stem, and are of a beautiful white colour. The fruit is like that of the cherry tree, and contains, when ripe, two seeds surrounded by a yellowish pulp.

After the fruit is plucked (the principal crop in the months from April to July) it is partly dried on the plantation in order that it may reach in safety, the manufactory where it is prepared for shipment; but on plantations of the first order this operation is generally performed within its precincts.

In some places the fruit is pulped in order to liberate the seed, which alone are useful. Before the seeds can be used they are roasted and ground, and great care has to be taken over this operation.

The usual adulterations of coffee are readily detected as roasting only slightly alters its microscopic character. We have first the testa or covering by which it is surrounded. This consists of a single layer of elongated adherent cells, resting on a thin membrane having an indistinct fibrous structure. The cells have oblique markings on their surface. This membrane can be readily removed from roasted coffee, as during the process of roasting it separates from the seed. It is known as coffee flights. A few small double spiral vessels are usually found in the groove or raphe which runs along each seed.

The seed proper is entirely made up of small angular cells, very firmly adherent, and containing in their interior deposits of oil. In the act of roasting the cells are charred, but their structure and shape are scarcely altered; the deposits of oil, however, are no longer seen in their cells, but are disseminated through the entire structure of the seed. Coffee contains no starch. We have, therefore, in pure coffee only to look for two structures, the cellular matter and the membrane, but the latter may be entirely absent, as it is of no value.

Coffee was formerly very extensively adulterated: the following are some of the substances used,—carrot, parsnip, beet, bean, lupin, dandelion root, chicory, mangold-wurzel, acorn, roasted grain (principally wheat), baked horse's and bullock's livers, venetian-red, earth, sawdust, &c. Of late years adulterations other than chicory are almost unknown; recently, however, date stones have been found in some samples.

The public, especially the poorer classes, have become so used to chicoried coffee, which gives a much darker decoction than the genuine article, that when they receive the pure coffee fancy there is something wrong, the prevailing opinion being that blackness is a test of strength.

The plant from which chicory is made is the *Cichorium Intybus*, of the tribe Cichoreæ, and of the order Compositæ. It is an indigenous plant with a perennial root, better known, perhaps, under the appellation of wild succory. The greater part is formed of rounded or oblong cells containing granular matter, and their appearance is very characteristic. The best seen and most distinctive character observed when examining coffee adulterated with chicory are the

pitted vessels; they are most abundant in the central and harder parts of the root, and exist in bundles. The laticiferous vessels are to be observed in the cellular tissues, and distinguish chicory from most other roots; they are much smaller in diameter than the pitted vessels. The woody fibre has no distinctive structure.

The best plan to make oneself familiar with the structure of seeds, roots, &c., is to take slices or sections from different parts, and in different directions, with a sharp razor. Before examining a sample of ground coffee, &c., it should at least be boiled in water. This has two advantages; first, it softens the tissue, and the particles can be flattened out thin by rubbing down with a penknife-blade or by gentle pressure on the covering glass; secondly, much of the colouring matter is got rid of.

If chicory is suspected to be present, it is best brought out by boiling with water to which a little caustic potash or soda solution has been added. This extracts all or nearly all the colouring matter as well as the oil, and renders the coffee very transparent, in fact too transparent for its structure to be distinctly seen, but the pitted vessels of the chicory are rendered very apparent, and the characteristic cellular matter can still be readily observed.

Dandelion coffee has been much advertised of late. The plant belongs to the same natural order as the chicory, and at first sight its structure might be confused with that of the latter. On closer examination the vessels are seen to be not pitted but spiral, and the ends of the filaments are often observed free from the ruptured ends of the vessels. The vessels are generally of the same diameter throughout, and the lines, where the cells have united to form the vessels, are faint. In the pitted vessels of chicory the cells are united more or less obliquely, and the lines of separation are very distinct. No cells containing granular matter like those found in chicory exist in the dandelion. Several makers guarantee their so-called dandelion coffee to consist only of roasted dandelion root, but the adulteration to which it is most liable is that of chicory, and the essayist stated he had met with one sample of reputed dandelion coffee which consisted of coarsely ground chicory alone.

Coffee contains no starch, and if beans, &c. (which contain starch), be suspected, a good plan is to boil, and to the clear, cold liquid add a solution of iodine, when, if it is present, a deep blue colour of iodide of starch will be produced.

The paper was well illustrated with microscopic drawings of chicory and coffee prepared by a process similar to that described in our Notes and Queries, and also by specimens of raw material, as well as sections which were exhibited under several microscopes. After the paper was read, the meeting resolved itself into the usual conversazione.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.

On Wednesday evening, October 13th, Mr. I. H. Jennings, President of the Science Section, gave an address on "The Preparation of Rock Sections for the Microscope," of which the following is an abstract:—

Nearly fifty years ago a professional preparer of microscopic slides first cut sections of fossil plants, for the purpose of displaying their structure. The process did not appear to attract any attention at the time, for it was not until long after that sections of minerals and rocks were prepared by Mr. Sorby, who introduced his method to the notice of the German petrologists, who not only recognised its value at once, but in a short time became most ardent and successful students of this branch of petrology. In England geologists sneered at the idea of examining rocks with the microscope. What could be seen in a structureless pitchstone or a black mass of basalt! Mountains should not be looked at through microscopes!

At the present day geologists generally acknowledge the value of the microscope as a geological tool; for when applied to the igneous rocks it reveals not

only their structure, but frequently their origin; applied to the sedimentary rocks it tells whether they are organic or inorganic, and what and how great alterations they have undergone since their deposition; besides bringing to our knowledge myriads of minute animals which have helped to build up many a vast formation, and of which, without the aid of the microscope, we should have remained ignorant.

Few objects for the microscope possess so much beauty as sections of rocks. If igneous, for the most part they are filled with crystals which glow with gorgeous colours when viewed with polarised light; if sedimentary, the field of the microscope often filled with tiny shells of exquisite form, showing us at one glance both the inhabitants and builders of a former world.

To prepare sections of rocks is by no means a difficult task. A cumbrous and costly machine is unnecessary. Sections, good and satisfactory in every way, may be prepared with very simple apparatus. This consists of the following: 1, an iron plate, about twelve inches square; 2, a coarse gritstone; 3, a Water-of-Ayr stone; 4, an Arkansas stone; 5, old Canada balsam (this cannot be too old); 6, a bottle of benzol or turpentine; 7, solution of balsam in benzol; 8, moderately coarse emery; 9, flour emery, or common knife polish; 10, a glass plate, about six inches square, common window glass, if with a level surface, will do.

I. Preparing sections of hard rocks: In the first place a thin chip must be procured by the use of a hammer. This chip should be about one inch square, and not more than one-eighth inch thick. Chips of sedimentary rocks may be thicker. Rub the chip down by hand with emery and water on the iron plate, until one side is perfectly flat. To remove scratches, next rub the chip on a glass plate with fine emery, and polish on the Water-of-Ayr stone. When quite smooth, wash it well, and let it dry. Meantime place some of the old balsam on a glass slip, and warm it over a lamp until all the more volatile parts of the balsam evaporate, so that, on cooling, it becomes hard and tough. Do not let the balsam boil. When the balsam is properly hard, warm the chip gently over the lamp, or on a hot metal plate, brush it over with a little turpentine, and re-melt the balsam. Then lower the chip slowly into the balsam until it is cemented firmly and evenly by its flat surface to the glass slip. When the balsam is quite cold, the chip is to be rubbed down on the iron plate with coarse emery until it is too thin to bear any further rough friction. With care many rocks may be brought to the requisite thinness on the iron plate alone, and will require little finishing. The necessary degree of thinness will vary according to the nature of the rock; but, as a general rule, most hard rocks must be cut thin enough to read through when placed on the page of a book. When the section will no longer bear the friction of the coarse emery remove it to the glass plate, and grind it thinner with flour emery, and finally finish it off on the Water-of-Ayr stone. The slide, at the finish, will be disfigured by deep scratches from the emery, and the section must be transferred to a clean slip. Warm the section enough to melt the balsam, and push the section off with a needle into a cup of turpentine, and wash carefully with a small brush. Now pour a little balsam and benzol solution on the clean slip, place the section upon it, add a little more balsam, and cover.

II. Preparation of soft rocks and sedimentary rocks generally: These are prepared and mounted in the same way as hard rocks *but no emery is to be used;* they must be ground down and finished on the three stones mentioned above. Some very friable rocks will require a preliminary hardening by immersion for some days in a solution of 1. balsam in benzol. The balsam must be first baked in a cool oven, until on cooling it becomes hard and brittle; then dissolve it in benzol; or 2., in a solution of shellac in alcohol. This is, perhaps, the better of the two. When the chip has remained long enough in the solution, it must be dried in a warm place. Sedimentary rocks, as a rule, do not require

to be cut so thin as igneous rocks, and they may also be left on the grinding-slide, which will not be scratched.

III. Preparation of sediment and sand. These are prepared in two ways: 1. Sprinkle a little on the sediment evenly on a slide, and run a little balsam and benzol over it gently, then cover with thin glass. 2. Moisten a slide with weak gum-water, let it dry, breathe on it, and sprinkle the sediment as before. When dry, mount with balsam.

To prepare some sandstones for mounting in this way, crumble a fragment either with the finger or with a stiff brush, and mount in balsam. In this way, and by the aid of polarised light, much may be learned of the composition and origin of sediments, and also of rocks, such as sandstones, which are too friable to permit of sections being made.

LETTERS TO THE EDITOR.

DEAR SIR,

I learn with pleasure, that you have projected a scheme for a journal, which will give fixity and *locus* to the many instances of industrious and careful observation on microscopical matters that are constantly made, but, in the majority of instances, nowhere permanently recorded. I am confident that if this be judiciously done, it may prove a great gain to microscopical manipulation, and methods of research, at least. It will have its influence on the structure of the instruments also, and will be a means of *suggesting* modes of working to serious and skilful labourers. I write of course mainly of the North of England, to which your proposed journal specially applies, and of which I have the most accurate information. For twelve successive years I have been closely connected with an important Northern Microscopical Society; and during that time many valuable papers have been read, and suggestions given, by several of the members, which either have never been recorded, or if so, only as being summaries; and in the pages of a scattered literature. It is true, The Royal Microscopical Society has, of late years especially, offered excellent facilities for the publication of all observations of value, and all ingenious inventions in methods and appliances. But my experience teaches that there are many valuable fragments remaining that only such a journal as you propose will be likely to secure: and although its mission may not be —does not aim at being—the highest, yet it will *point towards* even this, and serve an eminently useful purpose. I wish you all the best elements of success in your work.

Truly yours,

W. H. DALLINGER.

SHEFFIELD COLLEGE,

Sheffield, Nov. 18, 1880.

November 17th, 1880.

Dear Sir,

If circumstances permitted I should be very pleased to assist you in the manner suggested in your letter of the 6th inst. Unfortunately, however, I find it almost impossible to discharge my existing literary liabilities, and in illustration of that fact need only to direct your attention to the late appearance of Part II. of my "Manual of Infusoria" announced for November 1st. A few days' illness delayed its final revision, and has thrown me so much in arrears that I shall have hard work to make it up again.

At the same time, I wish every success to "The Northern Microscopist," and feel sure it will supply a great existing need. So soon as I am at liberty you may depend upon my support in the way of occasional contributions.

Many of the forms of Infusoria figured in the first number of my book were discovered by me when a resident in the Northern District some few years since. Notably: *Monosiga gracilis*, *Codosiga cymosa*, *Salpingœca ampulla*, and *S. cornuta*, all marine types obtained from the tanks of the Manchester Aquarium, then under my charge.

The accompanying pen and ink sketch I made from a piece of weed supplied by Mr. Thomas Bolton; and serves well to illustrate the great variety and abundant development of the Flagellate members of the Infusorial series, hitherto but little studied on account of their exceedingly minute size. You are welcome to make what use you like of it.

Regretting my inability to assist you further just at present,

I am, yours very faithfully,

W. SAVILLE KENT.

NOTES AND QUERIES.

Clouded Slides.—Can any of your readers tell me why some of my specimens mounted in Balsam have become cloudy and unfit for examination? *S. A. G.*

White Varnish.—How is the white varnish made which is now so commonly used for ringing slides, and how are the coloured rings produced? *Geo. Haines.*

Living Organisms.—It may be unknown to many of our readers that Infusoria, Entomostraca, and other living organisms, may be obtained at a very reasonable charge from Mr. Thomas Bolton, 57, Newhall Street, Birmingham. He has removed from 17, Ann Street, where he established a naturalist's studio some years ago.

SWINGING SUBSTAGES.—At a recent meeting of the Royal Microscopical Society Dr. Carpenter gave a description of a microscopic stand made by Mr. Wales, of New York, in which the inclination of the body did not diminish its stability. Dr. Carpenter also stated that he had worked with the Ross-Zentmayer swinging substage and had found it very serviceable. He would hail with satisfaction its application, or an equivalent, to all student's microscopes.

THE REPRODUCTION OF MICROSCOPIC DRAWINGS.—Drawings made upon paper with the aniline (graph) ink manufactured by Messrs. Judson and Sons, 77, Southwark Street, London, S.E., may be extensively reproduced by placing in contact with a layer of glycerine jelly, which produces a negative from which at least 50 copies may be easily obtained. By laying a sheet of writing paper upon the negative a slight pressure or smoothing action of the finger will give a very clear impression. The jelly may be made by soaking two ounces of the best glue in four ounces of water for two days, melting by means of heat, and when fluid stirring in 6 ounces of commercial, but strong glycerine.

HOW TO OBSERVE MELICERTA RINGENS.—For examination of Melicerta under the $\frac{2}{3}$, 4-10th, and $\frac{1}{4}$ inch powers, it may be advantageously placed in a slide trough or tube cell of about 1-6th of an inch or less, covered with thin glass. To do this an individual should be noted on the weed, conveniently placed on a leaf, or, still better, on the stem. With a small pair of nail scissors, the leaf on which the individual is placed should be cut off the weed, leaving a small piece of the stem attached, and so transferred to the trough or cell. It may sometimes be necessary, with the scissors, to pare down or split the leaf carefully without injuring the specimens, so as to reduce the leaf to a less width than the depth of the trough or cell. This being done, the leaf can be placed in the trough or cell sideways, and the piece of stem attached to it retains it in that position, otherwise the Melicerta tube, which is generally built in a position standing up from the surface of the leaf, would not be conveniently placed for examination. *Thos. Bolton.*

A CAMERA LUCIDA FOR EIGHTPENCE.—Mr. H. E. Forrest, F.R.M.S., has devised a small instrument simulating Dr. Beale's neutral tint reflector, for the purpose of sketching microscopic objects. Its price is sixpence, or post-free eightpence, and can be obtained from Mr. Thos. Bolton, 57, Newhall Street, Birmingham. During a recent visit to Birmingham, we gave this instrument a trial, and can confidently recommend it to our readers.

GLASS CRYSTALS.—It may be unknown to many microscopists that glass such as we see every day, can be made to crystallize. Fig. 1 shows a crystal, which appears to be the nucleus of a

hexagonal plate, and Fig. 2 is a more complete crystal of the same kind.

The crystals assume various forms; prisms and hexagonal plates are plentiful; while the "star" or "snow-crystals" are not so common. Many of the plates and prisms form exceedingly beautiful objects for the polariscope: not only do the crystals themselves polarize, but the glass immediately surrounding them often polarizes likewise to some extent.

Fig. 1. Crystal of glass × 170.

Fig. 2. Crystal of glass × 80.

The illustrations contained in this preliminary note have been prepared by photographing the crystal with the aid of a quarter inch objective; the collodion film was then transferred to the wood block, from which picture the engravers worked. *W.D.H., G.E.D.*

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

G. S. T.—Thanks; we will insert it in our next issue.

J. R.—Huxley and Martin's small but excellent treatise upon Practical Biology will, we think, suit you. Its price is six shillings.

GEORGE WOOD.—In reply to your query, we intend giving at least an abstract of the proceedings of as many Societies as possible in the North. It is also intended to print papers *in extenso* whenever they appear of sufficient interest to the bulk of our readers.

JAMES HILL.—If you look at this, our first number, you will probably find your query answered.

JAMES FOWLER.—We *do* intend to illustrate THE NORTHERN MICROSCOPIST, and thank you for the suggestions contained in your letter.

BRITISH WORKMAN.—We will see if it is possible to have some articles on the selection of a Microscope; but in doing so, we are afraid we shall not be able to please everybody in so guiding their choice.

THOMAS QUANT.—There is a small sixpenny *brochure*, published by Marshall, Japp, and Co., on "Ferns and Ferneries," which would suit your requirements. Most works upon ferns do not give instructions for their propagation.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

MARINE ALGÆ, and other well-mounted slides for exchange. Wanted mole-fleas and other parasites. Send list. C. J. Jones, 15, Princess-street, Manchester.

ÆCIDIUM RUBELLUM and urticæ wanted in exchange for other raw material. State wants. F. McKenna, Shaw Heath, Stockport.

MICRO-CHEMICAL SLIDES, Murexide, Hippuric Acid, Salicine, Santonine, Brucine, &c., in exchange for petrological or any of geological interest. A. H. Scott White, 99, Waterloo Crescent, Nottingham.

DUPLICATES for exchange. Will Microscopists send list in exchange for mine. "D.," care of Editor, Northern Microscopist.

GENERAL SLIDES in exchange for others. Mosses and lichens preferred. H. Baker, The Schoolhouse, Walkeringham, near Gainsborough.

SECTIONS of endogenous and exogenous stems, mostly exotic, well-mounted, and single and double-stained, for other well-mounted objects. W. Blackburn, Woodlands, Chorlton-cum-Hardy, Manchester.

ANT-LION.—For a well mounted slide of any rare moss, an ant-lion will be exchanged — unmounted. Write first to "Trochus," care of the Editor NORTHERN MICROSCOPIST.

EXCHANGE COLUMN, *continued.*

STARCH from rhizome of male fern wanted, unmounted. Exchange general slides; state wants. Also starch from yam wanted. The EDITOR.

MORRIS' ROTATING STAGE. This for exchange. Well mounted slides of algæ wanted. *Alpha,* care of Editor THE NORTHERN MICROSCOPIST.

JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY. The first 5 Nos., of 1880, published at 4s. each. What offers of slides? fungi preferred. "Fungus," care of Editor NORTHERN MICROSCOPIST.

SOWERBY'S handbook of the Aquarium in exchange for double stained wood sections. What offers? B. C., care of Editor NORTHERN MICROSCOPIST.

MYXOMYCETES for other slides of Micro fungi. Arcyria punicea and several species of Trichea offered. W., care of Editor NORTHERN MICROSCOPIST.

ANATOMICAL AND PATHOLOGICAL sections in exchange for bone sections. Henry Vial, Crediton.

For slide of hop mould send other slide of interest to John Boggust, Junr., Alton, Hants.

DIATOMS, well mounted, from Peruvian guano, in exchange for other good slides. Send lists to W. Hamilton Reid, Eaglescliffe, Yarm-on-Tees.

MOSSES wanted. Mosses of the genus Andreæa wanted in exchange for other British mosses. J. C., 33, Plymouth Avenue, Longsight, Manchester.

ODONTOPHORES of several species of land shells in exchange for good named varieties of British shells. J. D. Burterell, 2, St. John St., Beverley.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

FOR SALE, a half-inch objective by Dancer, with collar adjustment, will resolve angulatum. Price £2, or will exchange for a good herbarium of correctly named mosses of about 80 species and one of lichens of 100 species. "D." care of Editor NORTHERN MICROSCOPIST.

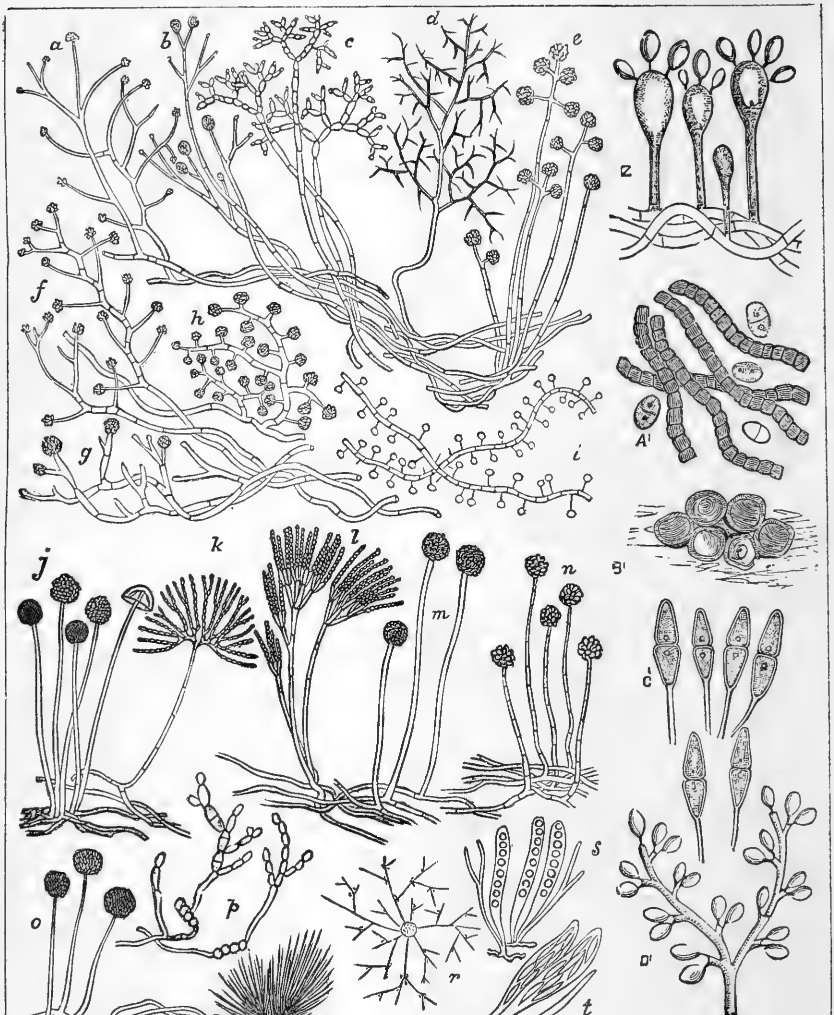
BOOKS for Sale. Quekett's Histology, Gosse's Evenings with the Microscope, Hogg on the Microscope, last edition. What offers? C. J. Jones, 15, Princess Street, Manchester.

WENHAM'S last illuminator for diatoms, new. Wanted 12 slides of well mounted mosses. "Micro," care of Editor NORTHERN MICROSCOPIST.

OBJECTIVE, quarter-inch, with collar adjustment, an excellent glass. Price £2. Also an aquarium, 22 × 12 × 15 inches. Price 20s. R. A. B., 6, Dover St., Higher Crumpsall, Manchester.

FOR SALE, a separating objective, 2 and 1 inch, by Dancer. Price 25s. Also a half-inch, by Dancer, at same price. J. C., care of Editor NORTHERN MICROSCOPIST.

MONOCULAR MICROSCOPE by Harris and Sons, Museum Street, three objectives, $\frac{3}{4}$, $\frac{1}{4}$, $\frac{1}{8}$, condenser, live-box, etc., in mahogany case, cost £8. Wanted geological specimens, especially bronze and flint implements. A. H. Scott-White, 99, Waterloo Crescent, Nottingham.



To face page 25.

THE NORTHERN MICROSCOPIST.

No. 2. *FEBRUARY.* 1881.

COMMON MOULDS AND MILDEWS.

THERE are no doubt at the present time thousands of microscopes lying idle, for the want of a subject to investigate, or perhaps because the first impulses which led to their purchase have died away, and all the slides of pretty objects, diamond beetles, polarizing crystals, butterfly's wings, and slides of a similar nature have become so common that it is weariness itself to look at them again. When this stage is reached, the possessor of a microscope generally takes one of two courses, in the first the instrument is neglected so that it eventually becomes a mere ornament on his table, or if it be not considered handsome enough it is put in its case and consigned to oblivion, from whence it is brought forth at intervals to exhibit some exquisite polarizing object, or perhaps a microphotograph to a party of friends.

The other course taken is that, when all the objects of interest which have been bought with the microscope are played out, a search for fresh specimens commences, and it is in this direction that we may be of some degree of usefulness to our readers.

There is no doubt that the microscope is often put aside owing to the notion of its possessor that real microscopic study is a difficult pursuit, but this unreal state of the case generally proceeds from observers who try to range over too much ground instead of confining themselves to one or two studies, and working out for themselves all that can be learnt respecting them.

There is not an insect which flies or crawls or swims which may not be made the subject matter of a moderate-sized volume; but as such studies demand more time and attention than many microscopists can give, it is not to be supposed that all possessors of instruments will engage in such work. It is desirable when investigations are undertaken that the observer should endeavour, wherever it is possible, to acquaint himself with the life-history of his subject; there is no better exercise for the faculties of the mind than in studying the means whereby this end shall be attained.

If it be an animal, it should be observed from the period of its birth through several successive generations; if a plant, it is usually much more completely under control, and should be watched more narrowly than in the former instance, from the germination of the seed or spore, until the same form from which it sprung has been produced again. Even this amount of watching is not enough; low forms of life are often troubled with what we have been pleased to call "alternation of generations," and so at times we are apt to think we have a new and distinct animal or plant, when in reality it is only another phase in the life-history of some well-known form.

We cannot all go easily to ponds and ditches, and neither can we all spare that amount of time necessary for the performance of insect dissections, and therefore we indicate a path for students in which good work may be done by the aid of but little and easily improvised apparatus. A few corks, pieces of wood, and thin glass covers produce all that is required, so that the score of expense should not drive longers after original research out of the field.

The subject is Micro-fungi, or rather a few of the common moulds and mildews which may be found by the microscopist within the precincts of his own castle, if the circumstances of moisture and other atmospheric influences have been favorable. The members of this branch of Cryptogams are singularly persistent; it is true that the mycelium or vegetative system is often extremely evanescent, but the spore or fruit from which the species is reproduced often lies dormant for years, reproducing its kind again when surrounding circumstances favor its vegetation.

If the reader refers to Plate II., which appears as the Frontispiece to this number, he will find delineated there various micro-fungi which form the subject of this article.

First, we will take the order of Mucedines. The plant shown at *c.* is the *Penicillum sitophilum*, formerly called *Oidium aurantiacum.* This fungus has proved a stumbling block to many pseudo-mycologists; only a few weeks ago we saw in a work by M. M. Chevallier and Baudrimont (Food and its Falsifications) the Eurotium fruit of *Aspergillus glaucus* figured as *O. aurantiacum*, though it could be seen at a glance that the fungus illustrated exhibited not a single characteristic of the *Oidium* genus.

It must not be supposed that there is no such fungus as *Oidium.* In 1871, Mr. E. Brown discovered a species on spent hops at Burton-on-Trent, to which Dr. Cooke gave the name *Oidium aurantium.* It forms dense bright orange tufts, sometimes several inches in length; the hyphasma is creeping, branched and septate, surmounted by simple or branched moniliform threads, which break up into sub-globose or elliptical spores. There are many other species of Oidium.

Myxotrichum is another genus of the order of Mucedines, and is illustrated in the plate by two species which are not rare, *M. chartarum* and *M. deflexum.* The former is shown at *v*, and is one of the most beautiful of the order. It forms little dark-grey patches, consisting of branched flocci radiating from a common centre, some of which have curved apices as shown at *v*, and by which appendages the species is easily identified. We have found this fungus upon dead sticks, straw, paper, cotton-goods, and even upon some cartridges of gun-cotton which had been put for safety in a damp cellar.

M. deflexum is shown at *w*. It is a species we have lately found growing upon woollen goods as well as upon damp paper, wood, and twig-hampers. They form little patches of grey downy balls, from which proceed a number of radiating threads, some of the larger of which are generally simple while the remainder have opposite and deflexed branches as shown at *d*. The spores are collected in patches about the base of the threads and are oblongo elliptical. The complete plant, as shown at *w*, forms a very good object for the half-inch objective. In the Mucedines the threads are never coated with any distinct membrane, which should be remembered when attempting to classify these growths. *Polyactis*, is another genus of this order, of which *P. cana* and *P. fascicularis* are commonly met with, the latter is figured at *e*, and may be easily mistaken by the tyro for a *Penicillium* or an *Aspergillus.* In these two fungi, however, the aerial hyphæ are colorless, while in *Polyactis* they are slightly brown. The most common habitats for these species are decomposing vegetable substances, such as rotting stems and leaves. One species of *Polyactis* is certain to be found upon decaying fruit; the finest specimens we have seen were culled from some plum-tart which had been neglected, owing to holiday making in the summer.

Another fungus of the same order is *Rhopalomyces pallidus*, shown at *g*, and was found on decayed Russian matting at Kings Cliffe. It has a pale fawn color, the spores are small, elliptical, and are attached to septate aerial hyphæ, the tips of which are swollen into areolate heads to which the spores are attached. We have found this species on decaying Hessians.

Rice paste often gives a red mould when neglected, which possesses a colorless mycelium producing short, erect branches, tipped with a red cellular head studded with oblong spores, the endochrome of which is bipartite. This mould is the *Papulaspora sepedonioides*, and is delineated at *h*. It is very probable that the ferment used in the rice-growing countries for producing a spirit from this grain is but a Saccharomyces condition of this fungus, exactly as the yeast plant is a similar condition of *Penicillium.*

Acremonium alternatum figured at *i*, is another of the Muce-

dines, to which the previous fungus also belongs. Its vegetative system consists of a colorless creeping mycelium, upon which are set short alternate branches, each of which bears a colorless globose spore. It is common on decaying leaves; we have also observed it on cotton fabrics, and it has several times cropped up during our experiments upon animal substances.

The next is a very common mould indeed: it is of the same order as the foregoing, and is named *Penicillium crustaceum.* This fungus is shown at fig. *l*, and is that which produces the blue mould upon our preserve pots. The spore-chains form brush-like heads to the aerial hyphæ, the sporidia are globose, and of the color of verdigris. These sporidia are able to multiply by budding when placed in a suitable liquid, producing at the same time a fermentative change. This is not peculiar to *Penicillium; Mucor* spores, with those of *Ascophora*, *Aspergillus*, *Papulaspora*, and others, will produce the same effect.

There is another species of *Penicillium*, figured at *k*, and known as *P. chartarum*, which possesses oblong pale olive spores. It was found upon wall-paper in company with various other fungi. Most of the species of *Penicillium* are very common, some of them are sure to spring up in almost every experiment however carefully conducted, and so hardy are they and so prolific, that they often threaten to annihilate the smaller number of less hardy fungi which may happen to be under cultivation.

At *m* and *n* are shown two species of *Aspergillus:* the *A. glaucus* at *m*, with its scarcely perceptible septate hyphæ and glaucous-green heads of sporidia, and the *A. roseus*, which is delineated at *n*, differing from the former in that it is rather rare, and the head of spores being of a rose-red color. It is found on damp paper, lint, old carpet, cotton goods, and similar substances.

The *A. glaucus* is a very common fungus and is most interesting, seeing that its two kinds of fruit may be so easily studied. The one kind are sporidia, produced (so far as we know at present) by an asexual process, and borne upon the tips of aerial hyphæ, at which point the receptacle is swollen out, so that the fertile stem appears a spherical mass of closely compacted spores. The other kind of fruit is of a more perfect character, produced by a sexual process. It was formerly called *Eurotium herbariorum*, and is far from rare. Even the casual observer must have noticed the yellow spots which often appear on neglected loaves of bread, especially if they have been cut open. Every one of these minute spheres is really the perfect or sexual fruit of *A. glaucus*, the spheres are the bright yellow reticulated perithecia, which are closely packed with the asci or spore-sacs containing the spores.

Rhinotrichum lanosum, the last of the Mucedines, is shown at *d*, and was first found on damp wall paper. It forms dense woolly

tufts with short branches, upon which are borne obovate hyaline spores attached to the tips by delicate apicules. It may possibly be that this fungus is only the conidiophorous condition of *Orbicula cyclospora*, but this remains open for investigation.

The Dematiei may now be considered, of which *Stachybotrys lobulata*, figured at *a*, is a common form. This is a black fungus, the flocci are septate and much branched, the apex of each fertile stem forming a small ramulose head or swollen receptacle, each ramulus being terminated by an elliptical spore containing two nuclei. Some spores are stated to be echinulate while others are smooth, but we have never met with any save the smooth variety. This species has been found upon damp linen, and upon cotton which had been placed in damp cellars.

Another species the *S. atra*, found growing upon damp millboard, is shown at *b*. The spores are ovate and brown, but not so highly colored as in the former species. It is said they are never echinulate, and are traversed by a thick septum.

Another of the Dematiei, and one which was at first confounded with the *Aspergillus* genus, is *Sporocybe alternata*, and shown at *f*. It is often found on damp paper, and is a very common fungus causing a black mildew upon cotton goods. It will be seen that the fertile flocci are branched alternately, the oblong sub-truncate spores being borne upon these, adhering to a slightly swollen receptacle.

At *o* may be seen figured *Periconia glaucocephala*, which was first found on rotting linen at Kings Cliffe. The tufts are delicate, the stems short, and composed of a mass of compacted threads, which bear large ovate spores at their free ends.

The next species is a very common fungus, and one to which we hardly like to apply a special name. It is the *Cladosporium herbarum* figured at *p*, but which Tulasne has clearly indicated to be only a condition of *Sphæria herbarum*. This fungus has been found upon damp linen, mildewed cotton, and in similar habitats, often in company with *Macrosporium cheiranthi*, which is also one of the Dematiei and is figured at *u*. Both these fungi are to be met with on all kinds of decaying substances, and both are probably different conditions of *S. herbarum*. The flocci of *C. herbarum* are olive brown or black, when mature, and the uniseptate olivaceous spores are borne from the sides or extremities of the aerial hyphæ. In *M. cheiranthi* the macrospores are borne upon short pedicels, they are dark multiseptate bodies as shown at *u*, and by no means uncommon.

Œdocephalum roseum, which is figured at *z*, is the last of the Dematiei we can describe. It occurs as very minute tufts scarcely visible to the unassisted eye; it is of a rose-pink color, the threads are equal, the heads subglobose, the spores are oval and smooth,

and are attached to the head by very delicate apicules. This species was found on old paper and rags in Millfield Lane, Highgate.

A very common mould is shown at *j*, which appears on bread, starch-paste, cooked potatoes, and almost every other substance used in the culinary art. The vegetative system consists of a colorless mycelium from which spring aerial hyphæ bearing sporangia at their summits. These sporangia are at first globose, finally when ripe becoming slightly oval, when they collapse; the empty sporrangium or spore-case falling down as a bell-shaped cap over the top of the fertile thread and scattering the mature spores around it. This fungus is the *Ascophora mucedo*, one of the Mucorini; but the members of this genus must not be confounded with the genus *Mucor*, in which the sporangium does not collapse, but simply bursts, and so scatters its spores. Although common, the *A. mucedo* is nevertheless very interesting and instructive, and the student will be repaid who studies its life history.

We have two members of the Perisporiacei which are often found on common objects: first, the *Chætomium chartarum*, shown at *q*, commonly known as "paper bristle-mould;" and the second, *Ascotricha chartarum*, figured at *r*. The former consists of a thin black sub-globose perithecium, containing sub-globose sporidia, and is found on damp straw, decaying paper, and such like substances. All the species of this genus are found in easily accessible places: *C. elatum* and *C. glabrum* on rotting straw, and *C. murorum* on plaster walls. The perithecium is usually surrounded by a grove of erect hyphæ, as shown in the illustration.

In *A. chartarum* the perithecium is a thin, olive-brown body, seated on branched radiating threads; the asci are compacted in this, and contain broadly elliptical chocolate-colored spores.

(To be continued.)

A FEW NOTES ON SECTION CUTTING.

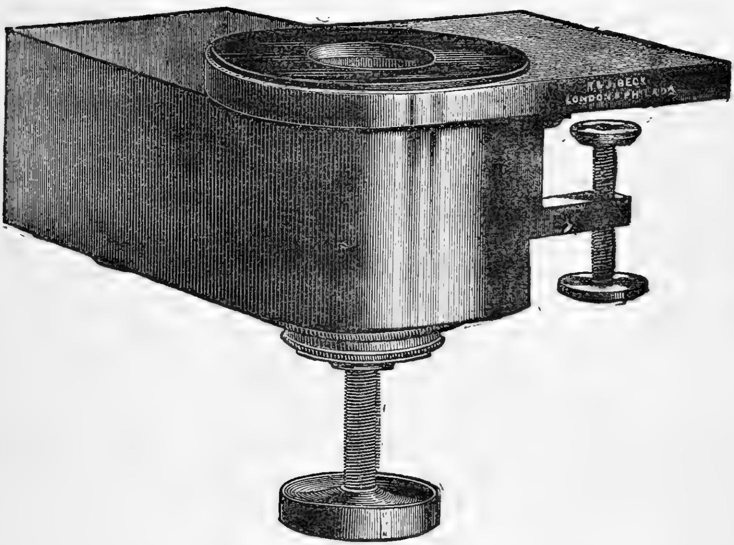
DO not be satisfied with mediocrity. Sections of moderate size may be easily cut without tearing and consequent disfigurement, and should they be torn cast them aside as there are are already too many of such preparations in circulation.

Now in order to produce good sections we must have suitable instruments to work with, notably, a well made microtome; and a knife, the edge of which rivals in sharpness that of the keenest razor. The selection of the microtome must necessarily depend on the quality of work expected from it; hard and soft bodies may require different instruments, still the microscopist who devotes his

time to section cutting will find in all probability that there are two forms which meet all his requirements.

For very hard substances Hailes' section cutter, sold by Mr. C. Baker, of Holborn, is no doubt the most useful, while for medical men and histologists generally, the form made according to Professor Rutherford's model is nearly all that can be desired, as it can easily be put to a variety of purposes.

By the kindness of Messrs Beck, of Cornhill, we are enabled to give our readers an illustration of this form of microtome which may be used in the freezing process or with a cereous bedding.



And now we come at once to a difficulty which has beset many operators, the contraction of the bedding agent during cooling, which causes it to become loose, thereby revolving and rising under the influence of the knife and so spoiling the work. Revolution of the bedding may be prevented in two ways: first by making the well of the microtome square which has been done in some few cases, or by imbedding in a mixture which does not contract during solidification. The most usual cereous bedding agent is a mixture of paraffin and hogs-lard, which always contracts very much on cooling, and so has set eager operators at work searching for some material, possessing all the advantages of the previous mixture with none of its disadvantages.

Some few years ago, Mr. John Barrow described a method of

cutting sections by bedding the subject in fused napthalin, which is not open to the objection of contraction during solidification; but which was afterwards improved, we believe, by Professor Williamson and Mr. Charles Bailey, by the addition of stearine. This mixture does not contract in the slightest degree in the well of the microtome; it is not generally known; but when tried fairly we think that all microscopists will be satisfied with it.

For some time there was a difficulty in procuring the materials at a reasonable price; this objection need no longer be urged as they may be obtained from Mottershead and Co., Exchange Street, Manchester, of a suitable quality, for the microscopist's use.

The great advantage possessed by the Rutherford microtome over most others, is that it may be used equally well for the freezing process. The tissue is hardened in the ordinary way, either in alcohol, bichromate of potash, or dilute chromic acid, and after cleansing, placed in the gum-bedding which is made by dissolving five ounces of picked gum-arabic in ten ounces of water, and when it has dissolved adding two drams of camphorated spirit and half a dram of glycerine, finally straining the whole through calico. After having been frozen with the usual mixture of ice and salt this medium cuts very much like a fresh gruyère cheese, and upon placing the section in water, the bedding agent quickly dissolves away leaving the clean section behind. The freezing process is specially useful for substances which have been injected with gelatine solutions, since it is clear that no imbedding agent to which heat is applied could possibly be used for this purpose.

OUR BOOK SHELF.

The Study of Rocks. F. Rutley, F.G.S. London: Longman, Green and Co. Pp. 319. 88 figures in text.

This little work is one of those, started by the publishers some years since, under the name of Text-books of Science, and is of the same quality as the others in the series, namely cheap and good, and as such can be confidently recommended to the beginner.

We may at first be inclined to consider the study of rocks a German one; not that we possess a dearth of workers in this country, but we have no elaborate text-books to guide us in our first attempts such as the students in the Fatherland have.

To those possessed of microscopes and not as yet active workers,

it would seem strange that rocks could be made to yield interesting objects—but such is the case, and as they learn that a common piece of limestone may be made to show its hidden structure by a little simple manipulation, bringing to light the beautiful skeletons of fossil foraminifera or the shells of mollusca, they cannot fail to take an interest in such a study, and wish to make themselves acquainted with the structure of rocks generally.

In order to commence the study satisfactorily, a text-book is certainly necessary, and the one under review may with confidence be placed in the students' hands; but it must be remembered that in order to study these things a fair knowledge of geology and mineralogy is requisite. It is one thing cutting and mounting rock sections, and studying them quite another; still there is no difficulty in acquiring a good knowledge of both these branches.

The book certainly supplies a want and should go far in creating a taste for petrological studies, and when this branch of microscopy has become more popular, our own petrologists, Sorby, Allport, Phillips, or our author, Mr. Rutley, may be induced to put our scattered literature in the form of a handbook, such as Zirkel's or that of Rosenbusch in the German.

The first four chapters are taken up with, Methods of research—Definition of rocks and their origin—Disturbances of the earth's crust, Structural planes, sedimentary rocks, and statigraphy—General character and mode of occurrence of eruptive rocks. Chapter V. relates to the collection and arrangement of rock specimens. Chapter VII. describes the microscope specially suited to petrological work, the author apparently giving preference to a monocular instrument. There are many microscopists who fail to appreciate the exact work suited to a binocular, and a word of warning may be given here to those who may be using the new short mount objectives with the Wenham prism. Let them read Dr. Carpenter's Microscope and its Revelations, p. 71, and they will see that our author, Mr. Rutley, is warranted in his preference. It should however be borne in mind that the Wenham binocular only reduces the angle of aperture in one direction, and therefore the object may be viewed without exaggeration if properly placed on the stage.

Chapter VIII. treats of the preparation of rock sections, Chap. IX. describes their examination, and X. treats of the microscopical characters of the principal rock-forming minerals, which turns out to be one of the most interesting chapters in the book, and one which will be of real value to the student.

Figs. 4 and 5 have been kindly placed at our disposal by the publishers, and serve to show how interesting some of these sections may be. Fig. 4 is a magnified section of a crystal of sanidine occurring in rhyolite from the Rhine, it is a good polariscope

object; and Fig. 5 is a section of Arran pitchstone under considerable amplification.

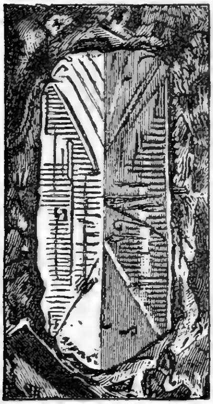


Fig. 4.

Fig. 5.

The remainder of the book is mostly taken up with Descriptive Petrology, chiefly of the Eruptive rocks, while a few pages at the end are devoted to those of a Sedimentary nature.

The book must find a place as a good practical text-book of Petrology, and its perusal is sure to save the student many hours of labour which are often wasted when he receives no extraneous aid.

NOTICES OF MEETINGS.

CHESTER SOCIETY OF NATURAL SCIENCE.—We have received the ninth Annual Report of this Society for the years 1879-80, from which it appears to be in a very flourishing condition. The chairman of the Microscopical Section is Dr. H. Stolterfoth, M.A. (who is also the Scientific Secretary of the parent Society); the Secretary of the section being Mr. J. D. Siddall.

The work of the Society seems to be the organization of

1. Excursions.
2. Evening walks.
3. Conversazione.
4. General Meetings.
5. Sectional Meetings.
6. Classes for Instruction.

The Annual Conversazione took place on 2nd October, 1879, in the Town Hall, and was one of the most successful ever held by the Society. We learn that a classified arrangement of objects shown under the Microscopes was furnished in the programme, and that the Society was aided by the Liverpool and Wrexham Societies.

The proceedings of all the Sections seem to contain matter of interest to the Microscopist, and therefore we extract the following from the report:—

The Liverpool Associated Soiree took place on December 10th, 1879, and many of the Members availed themselves of the friendly invitation they had received, and were thus able to see how matters were conducted on a grand scale, and in a place which offers so many advantages for the pursuit of Natural Science.

There have been six General Meetings during the winter of 1879-80:—

1879—Oct. 31.—"On the Border Lands of Science," by the President, Prof. T. McKenny Hughes.
Nov. 27.—"Clay, its nature and uses," by F. W. Rudler, Esq., Registrar of the Royal School of Mines.
1880—Jan. 29.—"The Trees of Old England," by Leo Grindon, Esq.
Feb. 26.—"Further remarks upon the Fungus of Diphtheria," by the Rev. John E. Vize, M.A., F.R.M.S.
Mar. 18—"Gleanings from the Natural History of the Ancients," by the Rev. W. Houghton, M.A., F.L.S., &c.
April 29.—Annual Meeting; "Floral Defences," by Rev. H. H. Higgins.

It will be seen, from the foregoing list, that our subjects have in no way been deficient in interest, and all of them have been so ably treated that it is a matter of regret that the attendance has not been better.

The different Sections into which the Society is divided have had their usual Meetings, and the following presents a list of the Papers read and discussed:—

Botanical Section.

1879—Nov. 6—"Winter Botany," by Mr. J. Price, M.A., Chairman.
Dec. 18—"Mosses," by Mr. J. W. P. Edwards.
1880—Feb. 12—"Plant Crystals," by Mr. J. Shaw, Junr.
April 1—"Leaves, their Structure, Functions, and Adaptation," by Mr. J. McKerchar.

Zoological Section.

1879—Nov 13—"Review of past year," by Mr. A. O. Walker, Chairman, and "Remarks on New Rhizopoda," by Mr. J. D. Siddall.
1880—Jan. 8—"An introduction to the study of comparative Osteology," (Part I.), by Dr. H. Stolterfoth.
Feb. 19—"Skin *verus* Bone," by Mr. J. Price, M.A.
April 8—"An introduction to the study of comparative Osteology," (Part II.), by Dr. H. Stolterfoth.

Geological Section.

1879—Nov. 20—"On the History of Geology in England during the last forty years," by Mr. D. Mackintosh, F.G.S.
1880—Jan. 15—"The Geological conditions under which the Diatomaceous deposit of Arenig Bach was formed," by Mr. G. W. Shrubsole, F.G.S., Chairman.
Mar. 4—"On the discovery under the Crewe Railway Station of clear traces of an Interglacial Dry-land Period in Cheshire," by Mr. D. Mackintosh, F.G.S.
April 15—"A description of the Ebbing and Flowing Well near Castleton, Derbyshire," by Mr. J. Mills.
" "Notes on the occurrence of Slickensides," by Mr. W. Shone, F.G.S., Secretary.

Natural Philosophy Section.

1879—Dec. 4—"Astronomical reasons for Changes of Climate," by Mr. Samuel Okell, of Bowden.
1880—Jan. 22—"American Storms: how and why they come," by Mr. A. Collenette, F.R.M.S., of Guernsey.
Mar. 11—"Spectrum Analysis," by Mr. J. H. A. Hall, of Bangor.

1880—April 22—"Modern Theories of Colour," by Mr. G. Watmough Webster, F.C.S., Chairman.

MICROSCOPICAL SECTION.

1879—Dec. 11—"On a newly-discovered Diatomaceous Deposit in North Wales," by Mr. W. F. Lowe, A.R.S.M., and Dr. H. Stolterfoth, M.A., Chairman.

1880—Feb. 5—"On the preparation of Sections of hard substances," by Dr. H. Stolterfoth.

Mar. 25—"On Staining Sections of Tissues," by Dr. T. S. Parry.

The Society is now working under five Sections, the latest established being the Microscopical. The Papers read at the Sectional Meetings have certainly been above the average, and we welcome new names on the list of contributors as an indication that interest in the work has in no way diminished. Some of the Papers have shewn much patient study and investigation, joined with rare powers of observation. We especially note Mr. J. D. Siddall's Paper on a "new Type of Rhizopoda," which in an enlarged form has since been published in the *Quarterly Journal of Microscopical Science* with a series of beautifully executed illustrations, also by Mr. Siddall. The discovery of the Diatomaceous Deposit at Arenig, by Mr. Lowe, also points to the fact that work in the lecture-room bears fruit in the open field. The Microscopical Section has only had three meetings, but they have been well attended by those who are in earnest about the work, and it is to be hoped that the study of minute structures may prove a help to our various sections. Mr. Siddall has kindly taken charge of the Microscopical Cabinet, which is open for the use of the Members.

LIVERPOOL MICROSCOPICAL SOCIETY.—The ninth Ordinary Meeting of the twelfth session of this Society was held on Friday, December 3rd, 1880, at the Royal Institution, in Colquitt-street. The chair was taken by Dr. Hicks, F.R.M.S., President. After the transaction of the ordinary business of the Society, the Rev. H. H. Higgins made some observations upon "Galls and the insects which form them," illustrating his remarks by exhibiting a large collection of galls from the museum.

The postponed discussion upon Mr. G. Massee's paper on the *Myxomycetes* did not actually take place, as owing to its non-appearance in *Science Gossip*, in which it was expected in December, the Members generally had not an opportunity of perusing it. The paper appears in the January number of that periodical.

Upon the conclusion of the ordinary business, the meeting resolved itself itno the usual conversazione, at which the following objects were exhibited :—

Antedon (Comatula)	...E. J. Sing
Diatoms	...T. W. Bruce
Infusoria Flagellata—new forms illustrated by W. S. Kent	I. C. Thompson
Leucophrys patula) Infusoria)	...Tapley Bacon
Miscellaneous objects	...Rev. W. Banister, B.A.
Pine Wood—transverse section	...Henry Kitson
Pollen	...Robert Nicholson
Do. various	...Thomas C. Ryley
Pond Life	...Dr. McClelland
Do.	...Alfred Leicester
Puccinia Circæa...	...J. Birdsall Jones
Tradescantia Virginica leaf stained	...A. T. Smith, jun.
Volvox Globator (taken from under thick ice)	.. H. R. Boult

The annual meeting of the Liverpool Microscopical Society was held on January 21st, at the Royal Institution, Colquitt-street, Dr. Hicks, F.R.M.S., the retiring president, in the chair.

On the nomination of the committee, Dr. Hicks and Mr. W. H. Weightman were elected vice-presidents, Mr. W. J. Baker and Mr. I. C. Thompson, F.R.M.S., were re-appointed honorary treasurer and honorary secretary respectively, and the following gentlemen were elected members of the committee:—Mr. John Abraham, Dr. M'Lelland, Mr. W. Oelrichs, Mr. J. M. Williams, and Mr. John Vicars.

The Rev. H. H. Higgins moved a vote of thanks to the retiring president and officers for their services, remarking that Dr. Hicks had conducted the discussions of the society during his term of office in a manner which must receive the warm approbation of the members. (Applause.) The motion was seconded by the Rev. W. Banister, and carried unanimously.

Dr. Carter, the president-elect, then delivered his inaugural address. In some preliminary remarks he criticised unfavourably the presumed universal diffusion of a single substance of uniform composition which serves as the physical basis of life. What at most could be meant, unless evidence was to be disregarded, was "protoplasms" (plural)—*i.e.*, the substance special to each kind of organism on the presence of which its vital manifestations might depend, and not a single protoplasm of undeviating composition, which lay at the root of all vital manifestations whatever. He drew attention then to the influence exerted by a number of agents on vegetable cell development, and more especially of light and darkness, pointing out simple apparatus by which the action of rays of light of different refrangibilities could be studied; of oxygen, carbonic acid, iodine, and ether. He gave illustrations in growing seedlings of the retarding effect exercised on vegetable cell-development of even very minute quantities of alcohol, one part in 400 often preventing development altogether, while a markedly retarding effect was produced by even one part in 3200. He also drew attention to the strong inherent vitality of the vegetable embryo of even the more highly organised plants by the power which it possessed of surviving even severe mutilation, illustrating the fact by a number of actively-growing seedlings reared from seeds which had been cut into various pieces and otherwise injured. A very interesting fact, which seemed to be established, was that light, either alone or in conjunction with moderate warmth, was not sufficient to develope chlorophyll in etiolated plants. Specimens of seedlings in illustration of this proposition, which is contrary to the generally received opinion, were exhibited.

The thanks of the meeting were accorded to Dr. Carter for his address, and the usual conversazione followed.

LIVERPOOL SOCIETIES ASSOCIATED SOIREE.—The fourth soirèe of the Literary, Scientific, and Art Societies of Liverpool was held on Wednesday, December 22nd, 1880, in St. George's Hall.

It was organised on a very grand scale, and seemed a perfect success, so far as the entertainment of the guests was concerned, every one seemed catered for, there was no *ennui.* The executive committee contained four members of the Microscopical Society, the Rev. H. H. Higgins being its Chairman, and to their efforts must be ascribed one of the most successful microscopical exhibitions Liverpool has ever seen.

Two lectures were interesting to the microscopist, the first in the Civil Court, where Mr. J. Swan delivered a discourse on his new system of "Electric Lighting for Domestic Use," and the easy manner in which he had the various lights under control with which the court was lit up, showed clearly that the intensity and actinism of this light might be easily adapted to photo-micrography and other microscopical uses.

The other lecture was delivered in the Grand Jury Room by Dr. Hicks, F.R.M.S. on "The Hydroid Zoophytes of the District," illustrated by the lecturer's original drawings displayed by the lime-light.

The Microscopical Exhibition was very interesting, the microscopes were placed in recesses round the Large Hall, the Liverpool Society being assisted by several members of the Chester Society of Natural Science.

The following objects were exhibited :—

LIVING OBJECTS—(Animal.)

SUBJECTS.	EXHIBITORS.
Circulation of the Blood in Newt	J. T. N. Thomas
Ditto ditto Web of Frog's Foot	G. S. Hicks
Floscularia ornata	Dr. McClelland
Fredericella sultana	William Russell
Gills of Mussel	William Shone, F.G.S. (Chester)
House Fly	Joseph Wall
Hydra viridis	Dr. Hicks, F.R.M.S.
Lophopus crystallinus	J. D. Siddall, F.R.M.S. (Chester)
Melicerta ringens	A. T. Smith, jun.
Miscellaneous objects	Thomas Bolton, Birmingham
Pond Life	Thomas Shepherd, F.R.M.S. (Chester)
Ditto	Edward Carter
Ditto	William Oelrichs
Ditto	John Vicars
Rotifers and other Pond Life	Herbert R. Boult
Spongilla fluviatilis	John Griffiths (Chester)
Stephanoceros Eichornii	J. W. P. Edwards (Chester)
Sun Animalcule (*Actinophrys sol*) Infusoria Flagellata, mounted and lent by W. Saville Kent, F.L.S. ...	Isaac C. Thompson, F.R.M.S
Synchæta mordax	George Thomas
Ditto	James A. Forrest
Winter Life in Fresh Water Aquarium	Rev. Neh. Curnock (Chester)
Ditto	Mr. A. Lucas (Chester)

LIVING OBJECTS—(Vegetable.)

Cyclosis in *Anacharis*	Malcolm Guthrie
Ditto *Nitella*	Fred. Robins
Ditto *Vallisneria*	Fanny Robins
Ditto ditto	H. M. Bennett
Glands of Sundew	J. Shaw (Chester)
Ditto	William Oelrichs
Ditto	John Vicars
Spores of Horse-tail	J. McKerchar
Volvox Globator	Sydney Robins

ILLUSTRATIVE OF ANIMAL STRUCTURE.

Antedon (Comatula)	E. J. Sing
Compound Eye of Beetle, showing multiplex image of photographic portrait	Charles Botterill
Eggs of Animal Parasites	J. W. Scholefield
Elytra of New Zealand Beetle	Charles S. Patterson
Eyespot of Peacock's Feather	W. Prior Christian
Insects, various	Rev. W. Banister, B.A.
Physiological Specimens, &c.	Alfred H. Mason, F.C.S.
Spines and Hairs of Caterpillars	Henry C. Beasley

ILLUSTRATIVE OF VEGETABLE STRUCTURE.

Pollens, various	Thomas C. Ryley
Sarcina Ventriculi and other Fungi	Dr. H. Stolterfoth (Chester)
Starch Granules—polarized light	Henry Kitson
Starch in Cells of Potato by polarized light	W. Hodges (Chester)
The Home of Wood Lice...	Rev. Thomas Lunt

FORAMINIFERA, POLYCYSTINA, &C.

Groups of rare *Polycystina*	Tapley Bacon
Polycystina and Spicules, with parabolic illumination.	Robert Nicholson

DIATOMACEÆ, &c.

Arranged Diatoms	Thomas W. Bruce
Desmids and Diatoms	George F. Healey
Diatoms, various	W. J. Baker

POLARISCOPE OBJECTS.

Crystals	Dr. Symes
Do.	A. E. Fletcher
Platino-cyanide of Yttrium	Alfred Leicester

MISCELLANEOUS.

Electric Fluid under the Microscope ...	W. H. Okell (Chester)
Micro-Photographs	E. G. Tooker
Nature prints, &c.	J. Price, M.A. (Chester)
Photo of Pond Life shown under Graphoscope	C. R. Griffiths (Chester)
Specialities in Polarizing Apparatus	Washington Teasdale, F.R.M.S. (Leeds)

MANCHESTER MICROSCOPICAL SOCIETY.—At the meeting of the Manchester Microscopical Society, held on Thursday evening, December 16th, at the Mechanics' Institution, Mr. Thomas Brittain, Vice-President, presiding:—

Mr. A. W. Duncan read a paper on Cocoa and its Adulterations, being a continuation of a paper on Coffee and its Adulterations read at a previous meeting. He described the cocoa tree (*Theobroma cacao*) as growing chiefly in Mexico, the West Indies, and South America, great care being taken in the cultivation of the young plant, so as to produce healthy, strong, fruit-producing trees of seven or eight years' growth, previous to which time the flowers are periodically nipped off. A peculiarity of the tree is that it produces leaves, flowers, and fruit together, necessitating the gathering of fruit at different times. The cocoa bean contains half its weight of fat, a considerable quantity of which is extracted from the higher priced qualities. This fat is solid at ordinary temperatures, and does not turn rancid however long kept. After dealing with the microscopical structure of the cocoa fruit with the aid of diagrams and the black-board, Mr. Duncan referred to articles used as adulterants, such as animal fat, chalk, chicory, brick-dust, venetian red, peroxide of iron, starch, and sugar. Animal fat, starch, and sugar, however, are the usual adulterations. Starch, by forming a mucilage and surrounding the particles of cocoa really holds it in suspension whilst being drank. It also prevents the fat from running together and forming on the top of the cup as quickly as it would otherwise do.

Dr. Samelson, the Chairman, and others took part in the discussion afterwards, which was practically a resumé of arguments concerning Mr. Duncan's previous paper on Coffee. Some curious facts were elicited respecting various cheap coffees and coffee compounds sold as "French coffee," "Dandelion coffee," and others. One cheap mixture, sold at tenpence per pound, contained only five per cent of coffee; other samples contained from forty-five to eighty-five per cent of chicory, besides other ingredients.

A vote of thanks was accorded Mr. Duncan for his paper, and for a contribution of slides for the Society's cabinet; also to Mr. Levy Tetlow for samples of peat-bog from Oldham, which has been the subject of considerable attention lately, and is rich in fossiliferous vegetation.

The Chairman said his attention had been called by Mr. R. Graham to an article for cleaning jewellery, and described as a curious natural production, under the name of Silicon. This was nothing more nor less than a small solid cake of diatoms. A shilling box contained sufficient to mount thousands of slides.

The meeting having resolved itself into the usual conversazione, the remainder of the evening passed in the examination of various objects, including some beautiful slides of foraminifera, by Mr. T. W. Lofthouse; marine algæ and

zoophytes, by Mr. R. Brauer; and living specimens of fresh-water sponge (*Spongilla fluviatilis*), by Mr. H. C. Chadwick.

A practical mounting class has been formed in connection with the Society, at the meetings of which much information is disseminated, often of an original and interesting nature, the result of the experience of its various members, The Rev. J. G. Wood has consented to lecture at the forthcoming soirèe in February.

The ordinary monthly meeting of this society was held at the Manchester Mechanics Institution, on January 13th. John Tatham, Esq., president, in the chair.

The paper for the evening was by Thomas Brittain, Esq., on DRY ROT, but owing to the business lasting until ten o'clock, this subject was not reached, and no conversazione took place. The time of the meeting was taken up in considering alterations of the rules, which had been proposed by a special committee appointed at the previous meeting to consider the subject.

MANCHESTER CRYPTOGAMIC SOCIETY.—Meeting, December 20th, Dr. Carrington presiding. The Honorary Secretary read the minutes, along with a copy of the Annual Report, read at the previous Meeting. After confirmation, the Secretary announced that he had received the first three parts of Dr. Braithwaite's new work, on the British Mosses (author's proof), from the Author for the use of the Society. The thanks of the Society were cordially given to Dr. Braithwaite for his very considerate gift. The officers for the ensuing year were duly elected. Dr. Carrington, F.R.S.E., *President;* Mr. Thos. Brittain, Mr. P. G. Cunliffe, *Vice-Presidents;* H. Hyde, James Cash, and Thos. Entwistle, *Members of Council.* Mr. W. H. Pearson, *Librarian;* Mr. T. Rogers, *Secretary.* The future Meetings of the Society will be held in the Free Reference Library, King Street, on the third Monday in each month, at 7-30 p.m.

Dr. Carrington read his memoir of Mr. A. Stansfield, of Todmorden, the late general president of the Todmorden Botanical Society, so well known for scientific attainments, self-culture, and his love of British plants; the Ferns however, were his especial favourites; and at his fernery in the Vale Gardens, might be seen a collection not equalled in Britain for the number of species and varieties, which were indigenous to Britain.

To those who have not read Mr. Waugh's poem, called—"Eaur Folk," we might refer them to a few lines in that poem, descriptive of Mr. Stansfield's character, where he says—

"Eaur Abraham studies plants;
He caps the dule for moss and ferns,
And grooin' polyants."

Mr. Stansfield's life and Botanical associations were intimately interwoven with the life and labours of the late John Nowell, the Bryologist, who was the constant companion of his youth, his manhood, and his old age. Rarely have two lives like Stansfield's and Nowell's run so sweet and lovingly together; both having an humble origin. Unfortunately, Nowell's mosses were so lowly and uncared for that they brought him little else than a simple, happy life; whilst Stansfield's love of ferns was taken at a tide which bore him on to fortune. But this made no difference in the friendship of the two men, and it might often be seen that Nowell's humble mosses were screened from withering winds by the graceful fronds of Stansfield's ferns.

After the reading of Dr. Carrington's memoir, the time of the Meeting was occupied by an examination of 24 species and varieties of British Sphagnaceæ, which had been beautifully mounted by Mr. P. G. Cunliffe.

MANCHESTER SCIENCE ASSOCIATION,—One of the Microscopical Evenings of the above Association was held in the Memorial Hall, Albert Square, on January 11th. The subject chosen being Diatoms, and the exhibitor, Mr. Tozer, who, unfortunately, was unable to be present owing to ill-health;

but notwithstanding this, he placed his valuable collection, each of which has been picked, and contains about one hundred slides, on the table and were shewn under the instruments of the Members of the Microscopical division of the Association. The collection comprises gatherings from various parts of the world, and about fifty are mounted by an American. The arranged slides, both transparent and opaque were very choice: finally, our old friend "angulatum" was satisfactorily resolved, with low power objectives.

NORTH OF ENGLAND MICROSCOPICAL SOCIETY.—The last ordinary meeting of the second session of the above Society was held at the Science and Art Schools, Corporation-street, Newcastle-upon-Tyne, on Wednesday evening, December 15th; Mr. John Brown, Vice-President, in the chair. The minutes of the last meeting were read and confirmed, and two auditors were appointed to examine the Society's accounts. There was a good attendance of members, and the most interesting objects shewn were by Mr. T. H. Swallow, who exhibited the remarkable hairs on a petal of *Trichinium Manglesii;* Mr. George Harkus spores of *Saprolegnia ferax,* and Mr. H. French *Melicerta ringens,* found in a neighbouring pond, and believed to be the second local occurrence of the building rotifer.

POSTAL MICROSCOPICAL SOCIETY.—The Seventh Annual Meeting of the above Society was held on Thursday Evening, September 30th, in a large room at the Charing Cross Hotel,

In the unavoidable absence of the President, Dr. H. F. Parsons, the Chair was taken by Dr. Brown (Vice-President), who very briefly stated that Dr. Parsons' professional engagements prevented him being with them. The Hon. Secretary's report contained the following remarks:—

"The Committee of the Postal Microscopical Society have pleasure in laying before the Members their Seventh Annual Report. The Society at the present date consists of 155 Members, against 138 at the corresponding date last year.

It is much to be deplored that a great falling off has taken place in the willingness of some Members to circulate slides. About 690 are at the present time in circulation; of these, up to the present date a register has been made of 631, from which it appears that

12	Members	have circulated	1 slide each.
21	"	"	2
29	"	"	3
29*	"	"	4*
18	"	"	5
16	"	"	6
6	"	"	7
3	"	"	8
2	"	"	9
3	"	"	10
2	"	"	11
3	"	"	12
1	"	"	16
14	"	"	None.

It should be observed that four slides is the number that each Member is required to send round.

Although rule 15 is printed in bold type, and affixed to the lid of every box, it is very frequently ignored. The box, in its black wrapper, is frequently carefully wrapped in white paper, on which the address is written and stamps affixed, or a direction is securely affixed on one side of the package. Nevertheless, but few breakages have occurred, but it is believed that in every case where accidents have happened it has been through insufficient attention having been paid to this rule.

The way bill, too, is often unnoticed, and Members frequently send each box to the name which *once* followed theirs, regardless as to whether its situation may be altered, or the name entirely left out; by this means, one Member whose name had for a long time appeared on the way bill, did not receive a box for six months.

Too much care cannot possibly be given to the cement used in the preparation of dry mounts. Although almost any cement will hold for any length of time in one's private cabinet, none but the very toughest is at all suitable for our travelling boxes; zinc—white, which is a favourite cement with many, being much too brittle. Many dry mounted slides come to grief in the post, and when such is the case, nothing but the glass slip, and occasionally also the cover glass is saved, the object, in nine cases out of ten, being lost or overlooked, so that it never comes to hand."

The business of the evening being finished about 9 o'clock, the meeting resolved itself into a Conversazione, at which the following objects were exhibited.

The President (Mr. Washington Teasdale, F.R.M.S.) brought a very conveniently arranged Portable Microscope with Lamp and other accessories enclosed in one case, together with the following :—

1. Micro. rulings on glass and steel.

2. Type slide (with key) 60 species Foraminifera, prepared by J. D. Siddall, Esq., including some exceptionally fine forms of Lugenæ, etc.

3. Two slides, Diatoms (one selected) prepared and mounted by our venerable member Mr. A. Nicholson, on or about his 92nd birthday.

4. Pearson's Amateurs' Microtome.

5. Spring safety stage in ebonite.

6. Sheets of various curvilinear tracery, compound vibration and geometric.

7. Three sheets Photos of Micro. objects by Dr. Maddox.

8. Scientific diagrams, etched and drawn on gelatime films.

Dr. Brown exhibited and described some Living Eels found in ears of wheat.

Mr. C. N. Peal exhibited under his microscope some beautifully prepared diatoms, notably Craspedodiscus Arafurensis from the Sea of Arafura; and other slides.

Mr. Alfred H. Searle brought with him two microscopes and other apparatus, viz.,

1. Crouch's Binocular Microscope with concentric rotating stage fitted with Swift's popular achromatic condenser.

2. Collins' new Histological Microscope.

3. Williams' Freezing Microtome which attracted much attention, and with which Mr. Searle cut a number of exquisitively thin sections of Elder pith. This instrument was described in the Quekett Club Journal for May, 1876.

4. A simple instrument for holding clean cover glasses.

5. An instrument for holding glass slips whilst cleaning them, before using. Mr. Searle also exhibited a number of his own well prepared slides consisting of anatomical and other sections, Diatoms *in situ*, etc.

Mr. H. N. Maynard exhibited under his travelling tripod microscope, Möller's Diatom Typen Platte, consisting of 400 selected and arranged Diatoms—

And Mr. Allen exhibited some of Mr. C. Vance Smith's decolorized and excellently doubly-stained vegetable sections.

The President's address was of an unusually interesting nature; we wish space could be spared to print it *in extenso*, containing as it does many valuable remarks; we must content ourselves however with making the following extracts :—

"At one time an increase of the first extremely low rate of subscription was desirable, and indeed necessary; but the sudden and unexpected augmentation made in 1878 was an admittedly unwise step, and has been receded from, as assuredly it cost us the loss of many good working members, and it is desirable

to confess and record the fact as an essential part of the history of the Society, but the capabilities and possibilities of the P. M. S. are not otherwise than temporarily affected thereby, and if means can be devised of putting it on an efficient working footing in accordance with the intent and theory of its founders, real workers will again be enlisted in our service to take the place of those we have lost.

"There has appeared in our books one short note by Mr. Hammond which I am especially pleased to be the means of commending, not only to this Society, but to all scientific Societies; for the spirit in which it is written is precisely that which should animate the breast of every scientific man. The circumstances that called forth that memorable note, I will not fully relate, suffice it to say that a Member taking leave of us, in a by no means unkindly manner, gave full reasons for doing so, and one of them was thus worded,—'*I am convinced that I can lay out* 10*s. to bring me in a greater amount of scientific knowledge than I can ever hope to get from this Society.*' To this our friend Mr. Hammond writing for once in pencil, and stretching his hand from a bed of sickness, replied,—'*The value of his money is not the light in which a Member of a Scientific Society should view his connection therewith. It is a means of giving as well as receiving, and surely the value of each Member must depend more or less upon the extent to which this is recognised. I do wish that each would therefore do what he or she can to contribute information on the slides as they come along, and in the pleasure of the effort the question of* 2. 6*d. or* 10*s. per annum will be lost to view.*'

"In the rules of most Societies, scientific or otherwise, there is generally a reasonable admonitory hint, that all who join them should contribute, more or less, to promote the objects for which they were founded. But so numerous are Societies now, and so great the advantages secured by Membership, easily and cheaply gained that it is too often forgotten that Membership has duties as well as privileges; yet before joining, any of these people are too ready to ask what personal advantage will accrue to them, rather than, how far they are able and willing to contribute to the common good.

"The advantages will certainly be undervalued by those who, dwelling in the Metropolis or large provincial towns, have opportunity of meeting frequently at scientific gatherings, and seeing all that is new in the way of apparatus and slides commercially offered to the public; but for isolated workers in remote country districts, particularly those of retiring habits and limited means, the circulation of our packets should form a bond of union, and a means of conveying information which could not otherwise reach them.

"The question of high or low powers has been frequently debated. One too often hears disparaging remarks made, as to the work done by those who have long used moderate powers, and assertions that work so done is untrustworthy, and will have to be done over again; whereas observations made with the highest powers are *prima facie* open to question, and not entitled to acceptation until they have been verified by independent (and preferably sceptical) critics, as the illusory images given by high powers are apt to shape themselves according to the theories of the observers; and even men who for a few years only have used high powers, may be led to consider themselves more competent discerners than those who for many years have pursued their investigations without, and yet this can rarely be the case.

"From the advanced standpoint of the present day it is we should take a hasty glance around. With the great German and other continental workers, communication has been chiefly restricted by diversity of language, and must to some extent continue to be so, for the same reason; but, thanks to the zealous labours of Mr. Frank Crisp and others, who conduct the affairs of the 'Royal Microscopical Society,' we have in its now excellent journal, early information and record in most convenient and accessible form, of whatever is being done in matters microscopical throughout the world.

"And now, in conclusion, and that those inclined to work earnestly, patiently,

and hopefully in the cause of science may be encouraged thereto, let me assure you, in the too little-known words of the poet statesman of America, (James Russell Lowell,) that—"

> "No power can die that ever wrought for truth ;
> Thereby a law of nature it became,
> To live, unwithered, in a sinewey youth
> When he who called it forth is but a name."

NOTES AND QUERIES.

CLOUDINESS OF SLIDES.—In reply to S. A. G., the following extract from the Journal of the Quekett Club may help him out of his dilemma.—*Philo.*

Read 23rd Feb., 1866, by Mr. D. E. Goddard. "A fruitful "source of annoyance is the appearance of a white cloudiness which "spoils many carefully mounted specimens. This may arise from "two sources. Dampness of the specimen, or the presence of "grease or fatty matter that has not been carefully removed before "applying the balsam.

"If a section of any sponge, such as may often be found on our "sea-coast, be mounted months after it has been gathered, this "cloudiness will ensue, because it has not been thoroughly dried. "To avoid such mishaps I employ one of three methods.

"1. Heat, sometimes direct, but more generally by means of a "water bath.

"2. By digesting the structure in strong alcohol before placing "it in camphine.

"3. By using a sulphuric acid bath, which consists of a large jar "containing a smaller one partly filled with the strong acid. Chlo- "ride of calcium would answer the same purpose.

"The object is placed on a slip of glass over the vessel contain- "ing the drying agent, and the whole rendered comparatively air "tight by a disc of glass. This plan I think most generally useful."

H.M.S. CHALLENGER.—The first volume of the Report describing the scientific results of the voyage of H.M.S. Challenger is published. It contains a provisional introduction to the Zoological section, by Sir C. Wyville Thomson, and six memoirs, namely, on Brachiapoda, Pennatulida, Ostracoda, the bones of Cetacea, the Development of the Green Turtle, and the Shore Fishes. Each memoir can be had separately, the prices ranging from 2s. to 15s. The entire volume is published at 37s. 6d.

LIVING ORGANISMS.—Since the publication of our last number, we have received several interesting specimens from Mr. Bolton's studio. The ovum of the large American trout, *Salmo fontinalis ;*

the elegant marine infusorian, *Follicularia ampulla*, from the Aston Aquarium; *Bursaria truncatella*, a large white ciliated animalcule found in ponds and ditches, amongst rotten beech leaves; and the marine Pterodina, *P. clypeata.*

The most interesting tube however was that containing a piece of sea-weed, upon which were clustered various organisms, notably *Vaginicola valvata*, exactly the same as the fresh water specimen, illustrated on Plate I. in our first number. There were also upon it some lovely *Spirorbis nautiloides*, a *Lepralia* occasionally protruding its bell of ciliated tentacles, and creeping about were some small Arachnida, with their bright red eyes and arborescent interior. Creeping and swimming were many rotifers, forming a goodly collection, and likely to afford endless amusement and instruction.

PRIZES FOR MICROSCOPY.—Two funds have been established in connection with the Royal Microscopical Society of London, one by Dr. John Anthony, the provider of a gold medal to be given trienially to the originator of any important improvement in the construction of the microscope, or any of its appliances; and the other by Mr. Frank Crisp, for a gold medal to be awarded to any one who promotes the advancement of research in natural science in connection with the microscope. The intention of the one donor is to place in the hands of the Society a tangible means of signifying their approval of any special and successful efforts to advance the construction of the microscope as an instrument of research; while the intention of the other is to enable the Society to honourably distinguish any special and successful research conducted mainly by means of the microscope.

CHAT MOSS.—Chat Moss being still a large tract of uncultivated land, although annually being brought more and more under cultivation, and though it has been subject to repeated and extensive firing during the past few years, yet the Moss and the adjoining woods, which are principally composed of fir, birch, oak, sallow, and poplar, with a great variety of undergrowth, is still doubtless one of the best collecting grounds in this part of the country. During the busiest part of the collecting season it is no unusual thing to meet with collectors from various parts of the country, and I think it may fairly be called the "happy hunting ground" for Lancashire collectors, especially for entomologists. But not to entomologists alone is the place interesting. For the collector of fungi, the botanist, the ornithologist, or the naturalist in any department, it is a fine collecting ground, where each may pursue any particular branch in which he takes the greatest interest.—*Read at a recent meeting of the Bury Natural History Society.*

ROYAL MICROSCOPICAL SOCIETY.—At the meeting on December

8 (Mr. J. Glaisher, F.R.S., in the chair) Mr. Wallis exhibited a new rotating substage; Mr. J. Mayall, Jun., his form of spiral diaphragm, and Tolles' mechanical stage of extra thinness; Mr. Crisp, Crouch's histological microscope, Parkes's demonstrating microscope, Holmes's compressorium, and Attwood's rubber-cell. A paper by Dr. Hudson was read on a new *Œcistes (Janus)*, and a new *Floscularia (Trifolium)* found by Mr. Hood, of Dundee, in Loch Lundie. The trochal disc of the former formed a link between that of *Melicerta* and *Œcistes*. The latter was remarkable as having only three lobes, and being much larger than any *Floscularia* hitherto known. Mr. Stewart explained some peculiar structural features of the Echinometridæ, illustrated by specimens and drawings.

British Fungi.—"Grevillea" for December, 1880, contains an index of British Fungi described or noticed in the first eight vols. of that serial. It has been compiled by Mr. Greenwood Pim, M.A., F.L.S., and will be of much service to mycologists.

Myxomycetes.—"Science Gossip" for December, 1880, has an excellent article by Mr. G. Massee, of Scarborough, on this order of Fungi. This order is now of especial interest, as it has been included amongst the Infusoria in Mr. Saville Kent's new Manual, now publishing. Earnest observers of this class of fungi are now required, to work out the various life histories and discover fresh facts.

Bacteriaceæ.—A general review of the state of our knowledge regarding these protophytes has been given by Dr. Luerssen in the Revue Internationale des Sciences Biologiques iii., 1880, p. 242, which should be read by all interested in these minute organisms.

Fluid for homogeneous immersion objectives.—Dissolve crystals of sulphocarbolate of zinc in an equal weight of Price's glycerine with the application of sufficient heat to boil the glycerine. The mixture must be boiled for some time after the crystals have all dissolved, otherwise the zinc salt is apt to crystallize by long standing. This solution is very viscid, and the front lens of the objective should be covered with a film of moisture by being breathed upon before racking down into the fluid. Mr. Bragdon, who devised this mixture, seems to be searching for a more mobile fluid; but when we remember that the viscidity of the above solution allows the inclination of the body of the microscope to a greater extent than a mobile one, it will always recommend itself to many workers.

Mounting objects in fluid.—Probably one of the best fluids for the preservation and mounting of certain objects, such as starches, is dilute carbolic acid solution. Keep a stock solution of

1 part of Calvert's crystallized carbolic acid in 100 parts of water, and dilute one part of this with ten parts of water when required for use. It may be used in almost any kind of cell.

CLEANING DIATOMS.—I should be glad of the information how to obtain diatoms perfectly free from earth and other impurities. I have frequently succeeded in cleansing them; but have almost always failed in separating them from the muddy and siliceous particles by which they are generally surrounded.—*Arthur J. Doherty.*

THE FAIRY SHRIMP.—On Dec. 21st in last year, Mr. Blatch exhibited at a meeting of the Birmingham Natural History Society a dead specimen of the above, which is, with one exception, the largest of the British Entomostraca. Since then I have visited Knowle, and collected six specimens of "the fairy shrimps,"—*Chirocephalus diaphanus*—one of which is a male. Two of these I send to different Societies for exhibition, and two are looking well in my aquarium, and I hope to be able to breed them, as the female is carrying a large bag of eggs.—*Thomas Bolton.*

INSPECTOR OF SALMON FISHERIES.—Professor Huxley has been appointed to the post of Inspector of Salmon Fisheries, rendered vacant by the death of Mr. Frank Buckland. The salary is £700 per annum. In accepting this, Professor Huxley resigns his appointment as naturalist to the Geological Survey.

FREE LIBRARIES.—To the student of Microscopy these institutions are invaluable. Private libraries of any extent are very expensive matters, and can only be formed by those who have space as well as means at their command.

If the student requires a book, not to be found upon the shelves of the Free Library of his town, he should bring the matter before the Council of his Society (if he belongs to one) with the request that they should propose the same for purchase to the Free Libraries Committee. If the book be a *bona-fide* standard work of reference, the Committee will scarcely refuse to purchase it, unless it be in those towns where Punch, Fun, and the Illustrated London News form the principal works of reference.

Huddersfield has lately declined to adopt the Free Libraries Act. Out of fifteen thousand burgesses only 3,000 voted, and of these 2,425 were against its adoption.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

J. P. G.—The communication came too late for insertion in the present number, as it required a wood-block. It shall be inserted in our next.

B.—Mr. Bolton, of 57, Newhall-street, Birmingham, we should think will be able to supply you with *Melicerta ringens.* (See advt. on last page.)

WILLIAM BLACK.—We shall be glad to have a few *notes* on starches; but one of our correspondents has an article in preparation on this subject, which will be well illustrated; the original pictures being photographed from the granules themselves.

A. J. D.—We have inserted your query, as no doubt there are several of our subscribers who will be able to answer you satisfactorily.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free.* They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY. The first 5 Nos. of 1880, published at 4s. each. What offers of slides? fungi preferred. "Fungus," care of Editor NORTHERN MICROSCOPIST.

DIATOMS, well mounted, from Peruvian guano, in exchange for other good slides. Send lists to W. Hamilton Reid, Eaglescliffe, Yarm-on-Tees.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

FOR SALE, a half-inch objective by Dancer, with collar adjustments, will resolve angulatum. Price £2, or will exchange for a good herbarium of correctly named mosses of about 80 species and one of lichens of 100 species. "D." care of Editor NORTHERN MICROSCOPIST.

FOR SALE, a large collection of Japanese ferns, in a good state of preservation, more than 100 different varieties, all collected by the advertiser during six years' residence in that country. C. O., Oakfield, Chudleigh.

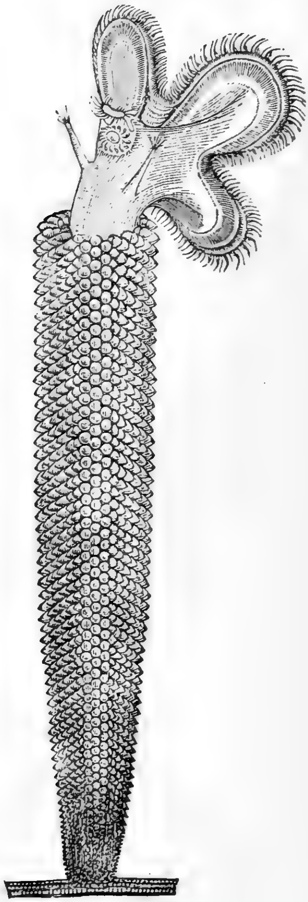
FIRST CLASS SLIDES, double stained vegetable sections, thirty subjects, suitable for science classes. Price 10d. each; 9s. dozen, selected, free.—J. A., Box 48, Gloucester.

WANTED, a good second-hand microscope, international binocular preferred. Address, J. Ormsby, 50, The Grove, Hammersmith.

CHEMISTRY applied to Arts and Manufactures, 8 vols., new, cost £4, for £2 10s.—Thos. B. Brindle.

BENCH LATHE, 2¼ in. centre, 27in. planed iron gap bed, several chucks and tools, slide rest castings, partly fitted and surfaced, also four speed turned wooden flywheel, 50lb. weight, 27in. diameter. Price 50s. Address by letter—Wheatland, St. Olave's Warehouses, John-street, Minories.

SPLENDID SKELETON LEAVES, finished specimens and instructions for skeletonising and bleaching completely in one hour. Price 9 stamps, free.—Mr. Willis, Ardwick-le-street, Doncaster.



MELICERTA RINGENS.

discerns nothing but an opaque or semi-opaque tube standing up like a tall chimney, a little widening upward; for the timid little tenant, alarmed by the shaking of the table produced by the observer's movements in sitting down and preparing, has shrunken down out of sight into his snug castle. In a few moments, however, something peeps from the top; perhaps it is a simple rounded mass of crystal flesh, as in *ceratophylli;* or the long antennal tube of *cephalosiphon* thrust out by jerks, and vigorously thrown to and fro; or the two incurving horns of *ringens* slowly protruding.

Suppose it is the last-named species, the most attractive of all, perhaps I might say the most interesting of the entire class of Rotifera. As the rounded mass of translucent flesh still protrudes, crowned by its two horns, like the spines of a rose, two other organs suddenly appear, stretching out from another part of the convexity, two long clear tubes, extending horizontally, one each side, which are the feelers or antennæ. Now a quivering is discerned in the interior, and in a moment the extremity opens and unfolds into four wide rounded flat lobes, like the petals of a transparent flower. The plane of this flower-like disk is not horizontal, but more or less oblique, sometimes approaching to perpendicular, and the two petals which are the highest are considerably larger than the two that are lowest; the former being the fore, the latter the hind pair."

SPHÆRIA HERBARUM.

SOME writers have essayed to compare the "organic continuity" which obtains during the series of changes which takes place before the formation of the complete and perfect fungus, to the fructification and subsequent reproduction of phanerogams; but there cannot be cited a single instance of a strictly parallel case, or one in which such analogy is fairly comparable.

In following the old adage that a tree is known by its fruits, many mycologists fell into error in assuming that, starting with the fruit as a basis, species and even genera should be multiplied according to the varieties of the fruit; but Tulasne has done much work in trying to clear up the mystery which hung over these matters, and in working out the life-histories of various fungi.

It may be that many of our readers are unacquainted with the admirable works of the brothers Tulasne, and the exquisite steel engravings which they contain, and therefore, to illustrate a few remarks we are about to make upon *Sphæria herbarum*, we have reproduced on a smaller scale by means of photo-lithography plate

xxxii., which accompanies the second volume of "Selecta Fungorum Carpologia" of the brothers Tulasne.

Sphæria herbarum is a very common fungus, and may be found on dead herbaceous stems, on pea and bean stems in particular; though it may affect plants of very different genera, it is found wherever there is vegetation, and even upon decaying sea-weeds, so that the student need not seek long to find it. This fungus possesses at least five kinds of fruit, which circumstance has given rise, from time to time, to the formation of many spurious genera. This may be seen by reference to Plate IV., which is the reduced engraving already alluded to; but a photo-lithograph can hardly do justice to the original. There are many persons to be found who aver that many of these sketches must have had their origin in the imagination of the delineators, rather than the result of observation, but as many have admitted that one and the same fungus may have several kinds of fruit, it behoves us to be charitable, and allow, until it has been proved to the contrary, that the drawings of the brothers Tulasne are accurate in their details.

If several kinds of fruit are to be found on one species of fungus, the student's difficulty is increased; in his studies he has to be able to recognise the plant by means of any one of these, but if he can trace a family connection, he will ultimately have no doubt as to what genus the secondary forms of fruit should belong.

In *S. herbarum* the ascigerous form is that which is normal, but such forms as *Cladosporium* and *Macrosporium* are quite as often met with.

It was pointed out by Rev. M. J. Berkeley, in his Introduction to Cryptogamic Botany, 1857, p. 78, that in *Erysiphe* there are no less than five different forms of fruit, the moniliform threads on the mycelium, the asci in the sporangia, the larger stylospores in other sporangia, the smaller stylospores in other sporangia, and the separate sporules sometimes formed in the joints of the necklaces. How this has been modified by subsequent researches most of our readers will know, and the researches which form the subject matter of this plate are being confirmed more and more every day, showing that species and genera have been multiplied without occasion.

The observer on perusing Plate IV. cannot but be struck with the very diverse forms of fruit which one fungus may produce,—figs. 1 and 2 show the macroconidia, which have been regarded, and may be still by some, as *Macrosporium sarcinula*, but which Dr. Cooke says in his handbook, is "only a condition of *S. herbarum*." Fig. 3 is a good illustration of the pycnides which have been classified as *Myxosporium orbiculare* and *Cytispora orbicularis*. Figs. 4a, 4b and 5, represent stylospores, while the figures 6 and 7 show what is known to the beginner as *Sphæria herbarum*,

and he is often unwilling to admit that any form but this can be the fungus in question. The mature perithecia shown at fig. 7 contain the asci which are further magnified at 8, and have in their interior, sporidia, the number of which is usually eight. The perithecia are minute and black, and the sporidia oblongo-elliptical. They are at first yellow, then brown, and are multicellular.

The figs. 9-11 show the first formation of mycelium by the vegetation of the spores, whilst figs. 12-14 illustrate the formation of conidia, which many have called, and still call, *Cladosporium herbarum*. It is described as *C. herbarum* in Dr. Cooke's handbook, who writes as follows:—"Numerous species have been classified, but it is questionable whether they should not be united under this, which scarcely claims a place here as a distinct species, since Tulasne has indicated its affinity with *Sphœria herbarum*."

COMMON MOULDS AND MILDEWS.

(Concluded from page 30.)

WE now come to fungi of another order, the Sphæriacei, of which the asci and paraphyses of *Orbicula cyclospora* are shown at *s*. This species was found on varnished wall-paper in company with *R. lanosum* d^1, *P. chartarum*, and others. The asci and paraphyses are compacted within a dark, semi-membranous, semi-carbonaceous, reticulated perithecium, which is mouthless or closed, the paraphyses are branched, the asci cylindrical, containing globose hyaline spores. The outward appearance of this species is that of a small reticulated dark-brown ball seated on a distinct mycelium, much resembling, except as to color, the conceptacles of the so-called *Eurotium herbariorum*.

The *Ailographum maculare*, which is classified under the order of Phacidiacei is shown at *t*; it was met with forming small black patches on an old mat, and the illustration shows two of the asci containing the oblongo-clavate spores, which as a whole are contained within the elliptico-linear perithecium.

Two members of the order Elvellacei are shown at b^1 and x, the former, *Peziza Pigottii*, appears as small nearly hemispherical cups, growing on plaster ceilings. The hymenium is pale brick red with cylindrical asci, containing elliptical spores which possess a very distinct nucleus. The vegetative system or mycelium is white and downy, and which always precedes the growth of the cups. The *Pezizæ* are not by any means rare.

The second fungus of the order is *Ascobolus testaceus*, which was found on old sacking and may also be found on rabbits'-dung. It is a brick red species, the paraphyses become slightly thickened as they rise upwards, the asci are broadly cylindrical, the general

appearance of the fungus being that of an agglomeration of small waxy-red looking saucers as shown at x.

And now we come to a species of *Torula*, probably new, perhaps not, let us call it *Torula gossypina*, it appeared as a small black speck upon the inside of a bottle in which some other fungi were being cultivated. It spread with marvellous rapidity over the nidus (damp cotton), and the first production was cultivated until the area covered was equal to 10,000 times the size of the original: under all conditions of heat and humidity, and yet the only form shown was that at a^1. It was at first thought to be an *Arthroderma*, though this belief is now abandoned, and in regarding it as *T. gossypina*, a name suggested by Dr. M. C. Cooke, we hold the opinion that it has quite as much right to be regarded as a new species as many others in existing handbooks.

Puccinia graminis at c^1 closes our list of common moulds and mildews; it is given as a specimen of those micro-fungi which grow upon living plants. It is to be found upon the straw of standing corn. Those fungi which grow upon living plants are but rarely found on decomposing substances, though it is not quite certain whether one form of fruit may not be found on a decomposing nidus, as in *Sphæria herbarum.*

We have now indicated some work for the microscope. If the enthusiastic enquirer wishes for a subject let him take some paper, rags, sacking and other sundry materials mentioned in this article and place them in a hamper in a damp and not too cold cellar—let him forget them, and return again after some months, when no doubt he will find work for his microscope for the remainder of the year.

Now a word or two as to viewing and mounting such objects as these: it should be remembered that mounted specimens are worthless unless they show the characteristics of the species and genus. This observation may be taken to heart by some professional mounters; we have seen slides of *Mucor phycomyces* and *Aspergillus glaucus* sent out as such, which the mounter would never be able to re-name, were they returned to him without the labels.

The Mucedines give the preparer a little trouble, for not only do the spores leave the pedicels on contact with any fluid but the slightest touch is often sufficient to detach them. The writer has for some time past mounted species of this order dry, in brown varnish cells, which should be as shallow as possible to get the best illumination from above. The specimen should be detached from its nidus very carefully and laid out in the cell under a low power, so as to faithfully represent the natural plant, and then dried thoroughly over a box of chloride of calcium under a bell jar, before putting on the cover. We have many slides of the Mucedines

mounted in this manner which seem to be keeping well, but of course it is absolutely necessary to get rid of all moisture before sealing up.

The exceedingly dark and carbonized species are perhaps best put up in gum dammar dissolved in benzol, as the flocci can be seen to the best advantage when mounted in this manner. Those which can neither be mounted in dammar, nor yet dry, may be put up in glycerine jelly, glycerine, Deane's medium, carbolized water, or a solution of salicylic acid; but whatever be the medium do not proceed to ringing or ornamenting the cover glass until after a fortnight from the time of mounting, when every slide should be examined under a moderate power, and all imperfect objects discarded and cleaned off.

It is useless to keep slides of collapsed or burst threads or spores, and the sooner these abortions are expunged from our cabinets the better.

So much then for common moulds and mildews; observers are required even for these common productions, so that we may have their complete life histories. Here is work for a thousand microscopes, let us hope that some of the unused instruments may find it in this direction.

MOUNTING MARINE ALGÆ.

By C. J. Jones.

AT a recent meeting of our Microscopical Society some mounted specimens of marine algæ were shown, which though they were very well displayed had so far lost their colour as to be identified with difficulty.

Now I maintain that every object which is mounted for microscopical observation should show as many characteristics as is possible of the living plant, and the first thing one has to look to is the preservation of the colour. This, most mounters fail to do, for having mounted in balsam they have gone through the customary process of soaking in turpentine, and this has been the means of discharging the colour.

For my own part, I prefer to mount *all* marine algæ in balsam; some prefer glycerine, Deane's medium or glycerine jelly, while others extol the virtues of a fluid for this purpose. With many species of algæ, glycerine jelly or Deane's medium cannot be used so as to leave the specimen as it exists in nature, owing to an action on the endochrome, which often takes place in marine algæ, exactly in the same manner as with fresh-water species. Dr. Carpenter, in his work on "The Microscope," p. 351, shows

how the endochrome of certain Oscillatoraceæ is acted upon by weak syrup and by chloride of calcium solution, and it is just in this way that glycerine jelly and Deane's medium act upon some species of marine algæ.

I have the alga *Bangia fuscopurpurea* mounted in two ways, first in balsam and again in Deane's medium, the two appearing so different in character that any one not acquainted with the mode of mounting would have no hesitation in dubbing them as two distinct species. Suffice it to say that the balsam mount is much more natural than that in Deane's medium when compared with the growing plant.

Some marine algæ which I culled in 1873 in Langland's Bay and Caswell Bay, at the Mumbles, near Swansea, and which were mounted soon after in balsam, are now (1881) as good as the day they were gathered, the colours being nearly as fresh. The principal were :—*Ptilota elegans*, *P. plumosa*, *Dasya coccinea*, *Ceramium rubrum*, *Delesseria alata*, *Nitophyllum punctatum*, *Cladophora rectangularis*, *C. uncialis*, *Bangia fusco-purpurea*, *and Ulva latissima.*

The method I pursue is this :—The algæ are first washed in fresh water to get rid of all sea-salts directly they are taken from the sea, they are then floated on to writing-paper and dried by gentle pressure between sheets of white blotting-paper. When apparently dry they are put between fresh blotting-paper and packed away in a dry place where they must be kept perfectly free from the access of light.

When perfectly dry cut off the number of pieces required and soak in *old* oil of cloves for a sufficient length of time to render them transparent, keeping them in the dark during the whole time. When soaked sufficiently take them out of the oil and lay them upon clean white blotting-paper to absorb the excess, and mount in the ordinary way with cold balsam and benzol, on a cold slide, using a cold cover, and the result will be satisfactory. It is the operation of soaking the algæ in turpentine and the mounting in warm balsam that does the mischief, and it should not be forgotten that if the mounted slides are constantly exposed to the light they will bleach in time.

There are two points which should be noted : *old* oil of cloves must be used ; the *new* is clear and of a very light yellow colour, while the old is more viscid and of a clear light brown. The other point is in the preparation of the balsam, that used in the foregoing preparations is at least thirteen years old, and most, if not all, the turpentine it originally contained has evaporated from it ; it has been solid for years. The method I adopt for bringing it into solution is to pour some benzol into the jar in which it is contained, and when sufficient has dissolved it is poured out into the bottle marked balsam and benzol. By this means only a thin layer of

balsam is taken out each time, and having been exposed for a long time to the air it has lost the whole of its turpentine.

If any reader adopts this process I am sure he will be satisfied with it, but if any difficulties occur, I hope we shall hear of them in the "Notes and Queries" department.

DIATOMS: HOW TO FIND AND HOW TO PREPARE THEM.

From the American Journal of Microscopy, April, 1880.

A LITTLE experience will enable any one to find and to gather all he may desire. Those living in this city can easily procure many beautiful varieties by simply fastening a muslin bag like an umbrella cover to the hydrant. After securing a quantity of the sediment, empty it into a large fruit jar or other receptacle nearly filled with water, and let it settle.

The green, brown, or fawn-coloured scum on the surface of pools, bogs and marshes, is mostly diatoms, and it may be taken up by means of a spoon or bottle and preserved, always in alcohol and water, or dried upon paper. The living weeds should be taken carefully from their location without much compressing or washing. The finer water plants yield the richest harvest. Fresh water forms are sometimes found hanging in green-coloured masses from drains, sluices and water-pipes. To gather from the lake, a net of fine muslin, having an opening in the bottom in which a wide-mouthed vial is tied, may be towed at the stern of a steamer. The sediment left in the bottom of pails, barrels and other vessels, contain a good supply. To obtain varieties not found at home, open a correspondence with gatherers in other localities, who will gladly exchange. Lake Michigan alone contains probably several hundred kinds.

The process of cleaning diatoms requires time, skill, patience, and personal experience, in addition to what may be learned from others. After trying for a long time to dispose of sand and mud the novice will be more careful in collecting. After an explosion or two, involving the loss of valuable material, and possibly the destruction of clothing, he will learn that strong acids and other chemicals are not to be handled like water. Experience makes the process safe and comparatively easy, requiring but a few minutes' attention at a time. No one method will apply in all cases, for some gatherings are imbedded in stone, some cemented with lime, which require special attention, while many gatherings require nothing more than a strong heat to destroy the organic matter and leave them ready for mounting.

In recent gatherings, when the diatoms are clean, put them into a bottle containing equal parts of alcohol and water, where they may be kept as long as desired. When ready to transfer them to slides, all that is required with most varieties is to dip a few from the bottle with a pipette and put them on the thin cover glass, and after placing the glass on a strip of mica or of tintype, keep the whole at a red heat until the organic matter is destroyed and only the shells remain in white powder. The favourite method of Dr. Lionel Beale, is to place all diatoms, whether recent or fossil, in a platinum cup, and then keep them at a red heat for several hours, or until the carbonaceous matter disappears, leaving a pure white ash. Dilute nitric acid is then used to dispose of the carbonates, and the remainder is washed.

The following simple method of cleaning diatoms I learned of Prof. H. L. Smith, of Hobart College. Boil for 30 to 60 minutes in strong soap suds, wash thoroughly in soft water to get rid of foreign material, such as sand, flocculent matter, etc. How to accomplish this will soon be explained. On examination of the material, if organic matter be still present, put the mass into a test tube or other suitable vessel, and, after settling, completely turn off all supernatant water and add four or five times its bulk of nitric acid, and while boiling throw in small fragments of bichromate of potash to bleach. Some prefer chlorate, but the bichromate is sufficient, and danger of explosion is avoided. When the organic matter has been destroyed, a higher temperature will be required to boil the acid, indicating that no more is needed. Probably five or ten minutes will be sufficient. Wash in rain water or that from melted ice until a drop evaporated on a slide shows no residue around the edge, leaving a clean slide of diatoms. Never use hard water, for the lime in it will cause all flocculent matter to cohere in masses.

The methods given are all that is required for a large proportion of diatomaceæous material so far as disposing of organic matter is concerned. The sand and other indestructible matter must be eliminated by gravity.

Guano, Monterey stone, material containing lime, &c., requires harsher treatment and much more time.

Guano should be boiled at least two hours in soft water, or as long as any colouring matter can be turned off; then proceed as in fossil earths.

Stonelike masses must be broken down by boiling in a strong solution of soda crystals. After disintegration wash and boil for 20 to 30 minutes in strong nitric acid, and while yet boiling add about an equal quantity of muriatic acid, and continue the boiling from 20 to 30 minutes longer. After washing out the acids boil in pure sulphuric acid until the mass becomes inky black, then throw in fragments of bichromate of potash, and continue the boiling until

it becomes clean. If, on examination with the microscope, it is found there is much flocculent matter besides the diatoms and sand, it can be removed by boiling for a few seconds in caustic potash, and then turning *almost instantly* into plenty of soft water to destroy the action of potash. The diatoms are chemically free from all organic matter, and they may be dried and kept in small phials in powder, or be put into equal parts of alcohol and water, and kept for future separation from sand and other inorganic matter, or we can proceed at once to isolate the diatoms, also to separate into sizes. To do this, put the cleaned diatoms into a small bottle, fill with soft water, filtered, and after shaking thoroughly turn off all that floats after five seconds into a larger bottle. Repeat the process, and after some five or six repetitions we shall find very little but sand in the first bottle, which we will throw away unless some very large diatoms remain, which can be removed by drying on a slide and picking with a mechanical finger. As soon as the material in the large bottle has settled, turn off the water and return the material to the small bottle and repeat the process, allowing longer time to settle. This process may be repeated five or six times, or as many times as necessary to make the separation satisfactory, allowing more time on each repetition to settle. Another excellent method is used by Christian Febiger, of Wilmington, Del., whose arranged slides have attracted much attention. Strain through No. 18 bolting cloth to obtain large diatoms. The remaining small diatoms and sand must be placed in a clock crystal and rotated. The sand will go to the bottom and the diatoms can be poured off repeatedly until clean as desired.

It will be impossible to save all the diatoms in the repeated washings. So long as 100 slides can be mounted from a mass not so large as a small pea, be content to save time and patience by losing a tithe of the harvest. Do not be disappointed when you find hardly enough diatoms remaining to make a fair thickness of carpet in your phial, for if clean you will have sufficient for yourself and for several of your friends, even then.

For mounting, always place with a pipette a drop of the fluid containing them upon the cover glass, and never on the slide. Prof. Hamilton L. Smith was my teacher in this method, and I know of no other equal to it. Cut a piece of photographer's tintype into strips about one inch wide and three inches long, then cut away all except enough for a handle, leaving one inch square on one end. Bend the end of this handle and fasten into a cork in a bottle, which will serve for a holder. Upon this plate place the clean cover, and by means of a pipette drop a little of the dilute alcohol and diatoms upon it, and apply a gentle heat with a spirit lamp. The alcohol takes fire and burns off. The remaining alcohol causes the diatoms to become evenly distributed. If in-

clined to mat, touch with a hot pin or needle. Now bring the whole to a red heat for plenty of time to make the diatoms appear white and perfectly clean.

On the centre of the glass slip place a tiny drop of old balsam, and with a pair of tweezers place the cover glass over it and hold the whole over the spirit lamp until a sea of the bubbles is seen underneath. Remove, and with a gentle pressure with a pin place the cover. The bubbles will all disappear and the balsam will become hard. To secure the diatoms all in the same plane turn the cover side down and leave in a warm place.

The process of arranging diatoms is a simple one. The diatoms are picked one by one with a mechanical finger and placed where desired.

To prepare the slide put it on a turn table, and with a pen make a small circle in the centre to guide in placing. On the other side of the ink ring put a tiny drop of pure distilled water, and with a small fragment of gelatine size it, so that when the diatoms are arranged breathing on them will bind them in the size. The best bristle that I have tried to use in the finger was recommended to me by C. M. Vorce, of Cleveland, who has done much excellent work with the microscope and with the mechanical finger. He uses a cat's whisker, and I prefer it in most cases to any other. Prof. H. L. Smith uses a rubber tube with glass tips, through which he breathes gently to dislodge diatoms which adhere closely to the bristle. The breath is to moisten the slide and not to touch the diatoms until held to the side with the bristle.

OUR BOOK SHELF.

A Manual of the Infusoria. W. Saville Kent, F.L.S., F.Z.S., F.R.M.S. London: David Bogue. 1880. Pt. III. Pp. 289-432, with 8 Plates.

The third part of this valuable treatise has at length appeared, and the general style deserves as much praise as the two former.

In describing the animalculum *Heteromita lens*, which is here identified with *Monas lens*, the author offers suggestions which may possibly at no very distant date bring a rejoinder from Mr. Worthington Smith. On page 293 we are told that "So remarkable a likeness subsists between the so-called bi-flagellate zoospores of the potato fungus *Peronospora infestans* figured by Mr. Worthington Smith in the Monthly Microscopical Journal for September, 1876, and the typical adult zooids of *Heteromita lens* as here figured and described, that the author is unable to repress a suspicion that these presumed

zoospores actually represent examples of the present cosmopolitan animalcule."

A very interesting feature in this part is the general description of the members of the order Choano-Flagellata S.K. On pp. 326-329 we have a resumè of the author's researches upon the use of the "collar" in these monads—from which it would seem "that in conjunction with the centrally enclosed flagellum it constitutes a most admirably formed trap or snare for the capture and retention of the animalcule's food."

Several of these collared monads were shown in the plate accompanying our first number, notably *Codosiga botrytis*, which is described at some length on pp. 334-5. In speaking of the *Salpingœca Boltoni* the author refers to plate I of THE NORTHERN MICROSCOPIST, and says, "No fitter illustration of the abundant distribution of the flagellate infusoria can perhaps be cited than the drawing referred to, in which no less than three collared monads and two sedentary Pantostomatous species are, as observed by the author, grouped upon a small portion of a leaflet of *Myriophyllum spicatum*."

There are two features in Mr. Kent's work which strike us as being valuable to the majority of his readers. He gives the localities of many of the species: thus we learn *Codosiga pyriformis* "was found growing on the deserted polyparies of Hydroid Zoophytes and Polyzoa received from Brighton," while *Monosiga consociatum* was found "upon the carapace of a species of *Cyclops* taken from a mill-pond in St. Peter's Valley, Jersey." The other feature is that of measurements, which gives the microscopist something of a guide as to what power he may use for observation.

It will be seen that the majority of the species herein described are exceedingly minute and so require high powers; *Monosiga ovata* measures $\frac{1}{3,500}$ to $\frac{1}{5,000}$ of an inch in length, and *Heteromita lens* is similar in its dimensions. Such infusoria as these require at least an eighth objective to see them with any degree of satisfaction.

This part of the work will be especially useful to those who may be studying microscopically solutions of decomposing substances both animal and vegetable.

The London Catalogue of British Mosses and Hepatics. Published under the direction of the Botanical Record Club. Second Edition, 1881. London: David Bogue.

THE Botanical Record Club has for its objects, the verification, registration, and publication annually of matter relating to the distribution of British Plants, as may be furnished for that purpose by the members, or as seem to merit publication, either on account

of being hitherto unpublished, reported extinct, or by reason of previous confusion and uncertainty.

This Catalogue owes its existence to Rule III of the Club, which provides for the publication of data relative to the distribution of Mosses and Hepaticæ, and as a new edition has been called for, advantage has been taken of the opportunity to make some additions and corrections.

Note is made of the meagre information furnished from the Ouse province (4), the South Welsh (6), and the Orkney province (18 B.).

Many gentlemen seem to have assisted in the work attending the compilation and production of this catalogue:—Mr. Henry Boswell, of Oxford; Dr. Carrington, of Eccles; Rev. J. Ferguson, of Fern; Mr. J. E. Bagnall, of Edgbaston; are among the more familiar names.

Bryological students will find this a handy pamphlet.

Ferns and Ferneries. By the author of "Anatomy of an Earthworm," &c., &c. London: Marshall, Japp and Co., 1880. Pp. 48, figs. 14.

This *brochure* is one of those treatises which should be put into the hands of a student with his first microscope. In it he will see the wonderful forms and structure of ferns, their methods of reproduction, and how they may be preserved in their natural state; but above all there are a few pages exceedingly instructive to beginners, in which the method of observing the growth of the young fern from the spore is clearly set forth.

How many microscopists are there who possess *fern preparations* in their cabinet, spores and sori, stems in cross and vertical section, double and single stained, and yet are totally unacquainted with the life-history of a single species, who have looked at spores and sori innumerable, and yet never made the effort of allowing them to germinate and to observe them in their various and strange mutations.

Ferns are in general, easily accessible, and as they form interesting and instructive microscopic objects, it is well to know how they may be cultivated. This the author tells us in detail, which in our opinion enhances the value of the work. Those who have any practical experience of fern-growing, have probably discovered a truth in the maxim, that what is one man's meat is another's poison, and therefore it is a good feature to find methods for planting more than a dozen species.

Portfolio of Drawings and Descriptions of Living Organisms;

which have been sent out by Thomas Bolton, F.R.M.S. London: David Bogue. No. 4. 17 Drawings.

THIS portfolio issued in February, 1881, contains illustrations and descriptions of:—

VEGETABLE KINGDOM.

Desmids and Diatoms.	*Zygnema cruciata.*
Æcidium urticæ.	*Vallisneria spiralis.*

ANIMAL KINGDOM.

Acineta.	*Spirostomum teres.*
Dendrosoma radians.	*Cordylophora lacustris.*
Choano-Flagellata.	*Lucernaria auricula.*
Bursaria truncatella.	*Euchlanis dilatata.*
Marine Infusoria.	*Asellus vulgaris.*
Nassula ornata.	*Ilyocryptus sordidus.*

Argulus foliaceus.

NOTICES OF MEETINGS.

LIVERPOOL MICROSCOPICAL SOCIETY.—The First Meeting was held at the Royal Institution, Colquitt Street, on Friday, the 4th February, 1881, Dr. Carter, President, in the chair. The Hon. Sec., Mr. I. C. Thompson, F.R.M.S., announced the following donations, viz.:—Three slides, Marine Algæ, from Mr. W. H. Grattann, Torquay, (honorary member) and twelve slides illustrative of the use of wax cells for fluid mounting, from W. H. Walmsley, Philadelphia, U. S. A.

The following gentlemen having been balloted for, they were elected ordinary members of the Society, viz:—

Dr. Evans, Sandy Road, Seaforth.
Dr. Fitzpatrick, Litherland Park.

Mr. H. C. Beasley exhibited Swift's recent form of Petrological Microscope, in which the polariscope working on a pivot can be immediately centred and moved out of the way, the analyzer and quartz plate sliding into the optical tube.

At the conclusion of which the Meeting resolved itself into a Conversazione, when the following subjects were illustrated:—

Carchesium polypinum..........E. G. Tooker.
Circulation in American Trout..........H. R. Boult.
Cyclops quadricornis..........H. M. Bennett.
Diatoms from London Clay..........I. C. Thompson.
Do. various..........Tapley Bacon.
Electric Spark under the Microscope..........Thos. W. Bruce.
Fredericella sultana..........Wm. Oelrichs.
Mosses from Malay Peninsula..........Alfred Leicester.
Pond Life..........Dr. McClelland.
Do. ....J. T. N. Thomas.
Spirogyra nitida in conjugation..........George Thomas.

MANCHESTER CRYPTOGAMIC SOCIETY.—At the January Meeting of the Manchester Cryptogamic Society, Dr. Carrington, the President, brought before the notice of the Members a series of Hepaticæ which he had collected

at Killarney in the year 1861. He called especial attention to some specimens of *Radula aquilegia* which he had described in his *Gleanings amongst Irish Cryptogams*, published soon afterwards. One of the specimens was named *Radula aquilegia* var. major, but since that time Dr. Moore and Mr. G. E. Hunt had found the male plants, and Professor Lindberg had also during a visit to Ireland been fortunate enough to discover the fertile plant. Dr. Carrington having recently received specimens, strangely enough, through the executors of the late Mr. T. C. Austin, of America, he now no longer hesitates to rank it as a distinct species, and names it in honour of his late friend, Dr. Moore, of Dublin, as *Radula Moorei*. Dr. Carrington said that at the time he collected it he was strongly inclined to recognize it as a species, but in the absence of fructification, and in deference to the opinions of Dr. Gottsche and Professor Lindberg, he had then described it as a variety only.

MANCHESTER MICROSCOPICAL SOCIETY.—The February Meeting of this Society took place in accordance with the new rules on the 3rd inst., at the Junior News Room in the Mechanics Institute. John Tatham, Esq., M.D., the President, occupied the chair.

After the minutes of the Ordinary and Special Meetings held on January 4th, had been read and confirmed, the Hon. Secretary's resignation was announced and accepted.

Attention was next drawn to the Soiree announced for Saturday, February 24th, the Members being invited to hand in a list of the objects they proposed to exhibit.

Mr. John Boyd drew attention to a slide of Ixodes of the Tortoise exhibited under his Microscope, as showing with remarkable clearness the oral appendages of which he gave a short description, illustrating his remarks by means of diagrams drawn upon the black-board.

Mr. Thomas Brittain, one of the Vice-Presidents of the Society, then gave an interesting account of a visit to the subterranean canal at Worsley, and the finding of the fungi *Merulius lacrymans* and *Polyporus destructor*, of which the following is an abstract:—

In 1870, he made one of a party of Science Students who visited the Duke of Bridgewater's coal mines at Worsley. From 20 to 30 descended one of the shafts, finding that when at the bottom, they were upon the banks of an underground canal, whose windings extended for a distance of about eighteen miles. After sailing along the canal from shaft to shaft and examining the working arrangements of the mine, a visit was paid to the stables, which contained animals that had never seen the light of day, except that imperfect glimmer which finds its way down the shafts.

The boat which conveyed them along was furnished with candles, which just served to make darkness visible; until out of the rock at one point of the voyage they came across a gas jet which shed a strong and welcome light around. This gas-light had been burning for about ten years: it was the natural gas escaping from coal imbedded in the rock.

The most interesting objects met with, however, were the two fungi *Merulius lacrymans* and *Polyporus destructor*, which occurred in large quantities upon the arched roof of the canal. During the passage, large white patches were noticed overhead; but they did not attract special attention until they came upon one of them, hanging down, which was seized by several of the company. Upon arrival at home it was found that although the greater bulk of the material was merely the white cottony mycelium, there was a rounded patch of an orange color which contained the fruit, and which was shown to the members by the essayist.

A few years after his Worsley expedition, Mr. Brittain met with fine specimens of *M. lacrymans* on some rotten timber from a building in Oldham, which had been furnished by a scientific friend, and specimens of which were exhibited.

In 1878, Mr. Brittain had another opportunity of examining *M. lacrymans*, which was brought to him by a friend residing at Cheetham Hill, from the cellar of his house. The specimen was exhibited to the members—it was of a circular form, about eight inches in diameter, and the entire surface was covered with innumerable pores and dusted over with spores of a bright orange color.

At the close of the paper a discussion took place, in which Messrs. McLean, Doherty, Yates, Miles, Blackburn, Jacob, Boyd, Mestayer, Dr. Smith, Dr. Aitken, and the President spoke upon the subject ; by which means some interesting personal experiences of *dry-rot* were given, and it was elicited that the growth of the fungus might be prevented by due ventilation and dryness, and also by soaking the timber in creosote.

A vote of thanks was accorded to Mr. Brittain for his interesting paper, and during the the Conversazione which followed, the following objects were exhibited :—

Spores of the dry-rot fungus	Mr. Lofthouse.
Do. do.	Mr. Chaffers.
Dissections from the crab	Mr. Alston.
Wood sections (double-stained)	Mr. Richardson.
Multiplex images in Eye of Beetle	Mr. Boyd.
Ixodes of the Tortoise	Do.

MANCHESTER NATURAL HISTORY SOCIETY.—The ordinary weekly Meeting of the Lower Mosley-street Society was held on Monday evening, January 24th, the chair being occupied by Mr. Thomas Rogers. Most of the evening was occupied in examining, by means of Microscopes, various objects belonging to the vegetable kingdom, such as hairs, glands, and scales, the exhibitors being Messrs. Graham, Chaffers, Furnivel, Kennedy, and Hyde. Some of the objects exhibited were extremely beautiful, and were greatly admired, such as the stellate or star-shaped hairs of *Alyssum spinosum* and *Alyssum Wiersbeckii*, and the scales of *Rhododendron callaphyllum* and *Rhododendron Maddenii*. Several of the leaf sections shown displayed both hairs and glands, the latter being very conspicuous in *Boldoa fragans*, Lavender, and the Sweet-gale or Bog-myrtle. Mr. Robert Graham exhibited sections of the castor-oil seed, to show the aleurone grains, and also doubly stained sections of a fern stem in which were seen to advantage the fibrovascular bundles. Stained sections of the leaf-stalk of the water lily, in which were numerous stellate crystals, were shown by Mr. Furnivel, as were also the spore-cases of *Todea Africana*. The Secretary (Mr. H. Hyde) placed upon the table a skein of silk, and also two nests of the trap-door spider *(Mygale fodiens)* which had been sent by Mr. Albert Macdonald, of Queensland, a former Secretary of the Society, and who left eighteen years ago. The silk had been raised by Mr. Macdonald, and spun by his children.

MANCHESTER SCIENTIFIC STUDENTS' ASSOCIATION.—The opening of the present session of the Manchester Scientific Students' Association was celebrated on Wednesday night, January 26th, in one of the rooms of the old Town Hall, King-street, by holding a Microscopical Conversazione. A number of Microscopes belonging to various members were deposited on a table in the centre of the room, and in the course of the evening by their aid various objects of interest were shown. Amongst these were the following :—A section of the human eye, the scales of the sole fish, a number of the sections of coal from the Oldham measures, and the circulation in plants. The gentlemen who exhibited were Messrs. T. Armstrong, Noton, Johnson, Burnett, Killenbeck, Watts, and Dent. Prior to the instruments being made use of, the chair was taken by Mr. T. Armstrong, and the Hon. Secretary (Mr. George C. Yates) announced that Mr. Thomas Broughton, of Barton-upon-Irwell, had been duly elected a Member of the Society.

The Chairman said the Members would observe by the syllabus that a change has been made in the management of the Library; instead of the books being kept in that building as in days gone by, they are now stored in the rooms of the Society. The Library is available to Members every day except Saturday between the hours of twelve o'clock and three, when books can be taken out. On Saturdays the Library is open from eleven to one o'clock. Each Wednesday evening during the winter session it will be open from 6-30 to 7-30. The Association has a good collection of books, and he trusted that the Members would make use of them to a greater extent than they have hitherto done.

Mr. Thomas Brittain then addressed a few remarks to those assembled on the subject of the Microscope. It gave him great pleasure to be amongst the Members that evening, especially in connection with what he might call his favourite study. He had been a student of science through the microscope for at least forty years, and during this period it had been his pleasure to notice how gradually but steadily the study of the instrument had been coming into use. At the time to which he referred one could have counted on one's fingers the number of gentlemen who possessed Microscopes, and it was the same throughout the whole country. Medical men knew nothing about it then, the knowledge was not required, but at the present time a medical student was compelled, before he could pass his examination, not only to be acquainted with the use of the instrument but also to know a great deal about the human tissues. It was a most delightful study to everyone who engaged in it, and he had observed that it was beginning to spread not only amongst the wealthy classes but also amongst those whom we called mechanics. He might state that throughout nature, animal and vegetable physiology, geology, and even in chemistry and other natural sciences, the aid of the microscope was important. In conclusion, he expressed the pleasure that it would afford him to give information for the next two months and assist those Members who might visit him.

NORTH OF ENGLAND MICROSCOPICAL SOCIETY.—The annual meeting of this society was held on Wednesday evening, January 12th, in the Patents Rooms, Literary and Philosophical Society, where the Microscopical Society will meet in future, by permission of the committee of that institution. Mr. John Brown, vice-president, occupied the chair. The honorary Secretary (Mr. M. H. Robson) read the report, in which the committee congratulated the members with the assurance that, numerically and financially, they were in a good position.

The suggestions embodied in last year's Report were carried out as far as practicable. Two Conversazione were held, open to friends of members; tickets of admission were sent to the principal schools of the town for the use of advanced pupils, and a supply sent to the Literary and Philosophical Society, Art Gallery, Public Library, and Working Men's Club.

The arrangement for a series of lessons in mounting animal and vegetable preparations was not carried out, as those anxious for instruction failed to make a proper arrangement with the volunteer teachers, who would have gladly given their services if required.

The out-door meetings held in June and July were of a very enjoyable character, especially the second one, by permission of Sir Henry A. Clavering, Bart., at Axwell Park, and will probably be a marked feature in next year's proceedings.

In withholding in-door meetings during June and July, the recess is useful as not interfering with holidays, allowing members the opportunity in their excursions of prosecuting microscopical research in the open country.

The President of the Society having been elected a Fellow of the Royal Microscopical Society during his term of presidentship, members are now able to consult its Journal, which is a great advantage to those who wish to keep abreast of the times with reference to scientific discovery and inquiry.

The in-door meetings were many of them of a very interesting character; but upon the whole, considering that the Society numbers fifty-six members, some meetings were but meagrely attended, and but one paper—on "Salmon Disease, and its Cause"—was read by the Honorary Secretary.

A most important change has been effected, so far as the place of meeting is concerned. The utmost courtesy and consideration has throughout been shown by the executive of the Science and Art Schools, where this Society was inaugurated, and has since held its meetings: but many of the members also belong to the Literary and Philosophical Society, and a desire has been frequently expressed that future meetings should be held there, provided the necessary accommodation could be given by that institution.

The request has been granted in the most liberal manner, and the use of the Patents and Lecture Rooms accorded for regular meetings.

After according a vote of thanks to the retiring officers, Professor G. S. Brady, M.D., F.L.S., &c., was unanimously re-elected President. Localities to visit at out-door meetings in June, July, and August next were selected, and a vote of thanks to the Chairman terminated the proceedings.

NORTH OF ENGLAND MICROSCOPICAL SOCIETY.—The ordinary monthly meeting of this Society was held in the Patents Room, Literary and Philosophical Society, on Wednesday evening, February 9th. Mr. John Brown, Vice-President, occupied the chair. The minutes of the last meeting were read and other preliminary business completed, after which a most able paper by the Rev. W. Johnson, of Whitehaven, entitled, "An Introduction to the Study of Lichens,* was read by the Honorary Secretary (Mr. M. H. Robson). The paper was illustrated throughout with a beautiful series of dried specimens, drawings, and microscopic sections, showing the structure and method of reproduction in this order of plants. A hearty vote of thanks was accorded Mr. Johnson for this excellent contribution. There was a good attendance of members, and the numerous instruments brought were utilised for the demonstration of the carefully-prepared sections sent with the paper by the author. A vote of thanks to the Chairman terminated the proceedings.

* This paper will appear illustrated in a future number of the N. M.

NOTES AND QUERIES.

THE NORTHERN MICROSCOPIST for March and April will be sent to many who are not subscribers, in the hope of inducing them to send in their names with stamps, or P. O. O. for Six Shillings, for 1881.

Those who have been good enough to favor us with their subscriptions will see that according to the number of subscribers on our register, so can we afford to spend more money in illustrating valuable and interesting articles, and therefore we earnestly solicit the support of every one who is a member of a Northern Microscopical Society.

In order that THE NORTHERN MICROSCOPIST may become a medium of communication between the various Societies we have placed the Secretaries of many of these upon our free list, and if any have been omitted we hope they will send us their names.

On the other hand it is only right that we should expect a *quid pro quo*, and it is a fact that in several districts where both President and Secretary are upon our free list, we have not a single subscriber.

Surely every subscriber upon our books at present is acquainted with at least half-a-dozen other Microscopists, is it too much to ask them to try to secure half of them as subscribers to us? We thank those Secretaries whose exertions on our account have borne such good fruit.

PHOTO-MICROGAPHY.—In our next issue will appear a paper upon photo-micrography, illustrated with a Woodburytype permanent enlargement of the proboscis of the blow-fly, and several woodcuts. It should have appeared in the present number, but we had miscalculated the time necessary for the production of a Woodburytype picture.

MOUNTED SLIDES.—We have lately received several very good slides of P. Angulatum from Mr. J. T. Norman, and four splendidly cut sections of Lichens from the Rev. W. Johnson, of Whitehaven, consisting of *Graphis elegans*, *Physcia stellaris*, *Collema pulposum*, and *Nephromium lusitanicum*, in all of which the details are very clearly shown.

DAMAR MOUNTING MEDIUM.—What is the correct formula for this medium which is now used so much in lieu of Balsam?—*W.*

CEMENT FOR GLYCERINE MOUNTS.—What is the best cement for sealing covers of objects, mounted in glycerine, without a cell? —*W.*

DARK GROUND ILLUMINATION.—Is there any simple method for obtaining dark ground illumination without special apparatus? —*W.*

RE-UNION.—On Saturday, Feb. 5th, a re-union of past and present members of the Manchester Field Naturalists Society took place at the Trevelyan Hotel, Corporation Street, Manchester, to celebrate its 21st anniversary, and also to do honour to the founder, Mr. Leo H. Grindon. A large number of ladies and gentlemen were present.

MANCHESTER SCIENTIFIC STUDENTS.—The syllabus of the fortieth session has just been issued to the members. On the opening night, a microscopical conversazione was held. The lectures for the session are—Messrs. A. Duncan, on pure air; Hastings C. Dent, on the ethics of science; T. Armstrong, F.R.M.S., on some modern

developments of science; R. Fletcher, F.C,S., on self-acting domestic help; C. W. Maybury, F.C.S., on chemical philosophy; and W. Rideout, on the life history of *Dytiscus marginalis.* Dr. Evans is set down for a paper, and two evenings are devoted to short communications. The library is now available to the members, offices having been taken in a central situation in the city, where books are delivered to the members daily.

SLIP-CLEANING INSTRUMENT.—Mr. Searle brought this instrument before the notice of the members of the Postal Microscopical Society at their last meeting. It consists of a flat piece of wood 15 × 4 × ½ inch. Along each side of this and close to the edge is fastened a slip of wood 12 × ½ × ¼ inch, thus leaving a clear space of 3 inches between them, and in which the slips are arranged for cleaning. Two other loose strips 14 × ½ × ¼ inch are now placed upon the ends of the glass and are each secured at one end by being slipped into a staple. That portion of the wood on which the slip rests is padded with cloth. The rubber for polishing the centre of the slips is made by glueing two thicknesses of cloth on the end of a large cotton reel, a piece of wash-leather is stretched over the cloth and secured by being tied to the middle of the reel. Mr. Searle says it is desirable to have two of these padded reels, one to use with putty powder, the other to give the final polish.

THE TUBES OF INFUSORIA.—Engel thinks that the tubes of Infusoria have a composition analogous to cellulose, seeing that they behave in a similar manner with both mordants and dyes.

WHITE ZINC VARNISH.—This semi-fluid substance is made in a variety of ways; but one which I always adopt, and which yields me very good results is as follows:—The pigment is very finely divided oxide of zinc and the vehicle necessary to hold it in suspension is gum dammar dissolved in benzol. Take equal parts by weight of gum dammar and the finest oxide of zinc, dissolve the former in twice its weight of benzol, and when dissolved pour it into a mortar where it is to be mixed up with the oxide of zinc. The pestle must be used vigorously, and if required thinner it may be let down with benzol, or if thicker some of the solvent may be allowed to evaporate by exposure for a short time in a saucer or flat dish.—*Jack J.*

CATCHING PODURÆ.—These insects are to be found in damp warm cellars, or warm cupboards of old houses, under flower-pots and stones, in vineries and hothouses, and in many other similar places. They are mostly of a dull leaden color, wingless, and do

not undergo any metamorphosis. An illustration of one is shown in fig. 6, which has been enlarged about 20 diameters.

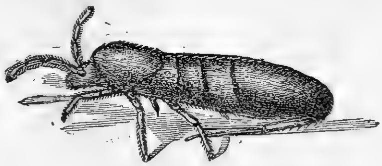


Fig. 6. Podura Plumbea.

To catch them, place near their haunts several large pill boxes containing oatmeal, the lid of the boxes being pierced with several holes large enough to allow the insects to crawl in. When caught, a few drops of chloroform may be poured in by means of a pipette, which renders the insects insensible, and therefore easily manipulated.—*J. P. G.*

The Fur Moth.—The Fur or Skin Moth *(Tinea pellionella)* is a little insect with silver-grey wings, marked with one or two spots. This moth is worthy the serious attention of dealers in furs and skins, because, under certain circumstances, it can cause enormous havoc. It lives almost exclusively on the skins, nips the hair off close to the roots, and pierces through in countless places, from the particles of which it builds a tunnel, serving the insect for its habitation.

Our Exchange Column.—Several correspondents have sent us letters to forward, referring to exchanges in our columns. They have forgotten, however, to comply with the instructions to send a penny stamp for postage with each letter, and therefore it may save us some trouble in the future if we state here how it should be done. The *nom-de-plume* only, must be written on the envelope enclosing the reply, ample space being left below for the address to be added by us, thus :—

“RAVENWOOD,”

and this together with a penny stamp for the subsequent postage of each letter must be enclosed in an envelope and addressed to the Editor. We cannot undertake to forward or return letters except on these terms.

THE AMERICAN MONTHLY MICROSCOPICAL JOURNAL.—The January issue of this Journal is full of interesting matter. The detection of adulteration in coffee—Infusoria on leaves—Mounting with glycerine jelly—Cells, their growth and functions.—A very practical article on The preparation and mounting of microscopical objects. A note on the resolution of *A. Pellucida*, and studies of atmospheric dust. These articles, together with many paragraphs of interest, as well as the proceedings of about half-a-dozen societies, should make the journal interesting to English microscopists. The subscription is low, and copies may be easily obtained in this country from 4, Lord Street, Liverpool.

HULME FIELD NATURALISTS.—At the meeting of this society, held in St. Michael's School, February 8th, Mr. J. D. Haigh, of the Manchester Microscopical Society, read a paper on Pollen and Pollen granules, their shapes and uses. The general rule amongst flowers was cross pollination, and self-pollination was the exception. Mr. Haigh described by means of diagrams the effects of different pollen on one stigma, and gave the opinions of different authors as to the manner in which it was carried about, exhibiting about thirty kinds of pollen under the microscope.

ANGULAR APERTURES AGAIN.—Pages 154-172 of the February number of the Journal of the Royal Microscopical Society are taken up with a paper by Mr. Shadbolt, on "The Apertures of Microscope Objectives" and the discussion thereon. Upon its perusal we are bound to confess that this dissertation does not seem to be of much practical utility. Turn-tables, and not "apertures" seem to be Mr. Shadbolt's *forte.*

ROYAL BOTANICAL AND HORTICULTURAL SOCIETY OF MANCHESTER.—A series of lectures on botany will be delivered in the above society's gardens at Old Trafford, by Mr. Leo H. Grindon, every Monday afternoon, during the months of May, June, and July. The members of subscribers' families will have free admission to these meetings, which are sure to be a source of pleasure and instruction to those who attend them.

WATER SUPPLY.—Dr. Frankland reports that the Thames waters supplied during the month of January, except that distributed by the Chelsea Company, were all efficiently filtered before delivery. The

Lea water furnished by the New River Company was of inferior quality, and contained moving organisms, while that sent out by the East London Company was superior to the supply in previous month.

In reading the above, which has been extracted from the columns of a London "daily;" it has occurred to us that microscopists generally are not aware how often *moving organisms* are to be found in tap water. Mr. J. Levick, of Birmingham, has found several rare forms in the tap water supplied by that Corporation, notably *Anurœa longispina*, *Triarthra longiseta*, and a long list of other species. The paper which Mr. Levick contributed to the "Midland Naturalist" concludes as follows:—"Possibly some who take great interest in the purity of the water supply of Birmingham may feel alarmed by this somewhat formidable list of dreadful sounding names of the living organisms it contains, but, perhaps it may help to comfort them to suggest that the presence of these organisms should be taken as indicative of the general good quality of the water than otherwise, as some of them at least are at home and abroad known as inhabitants of deep clean water only."

WHITE VARNISH for ringing slides may be prepared as follows:—one ounce of benzine, half ounce of gum damar, and white oil paint q.s.; dissolve the gum damar in the benzine, and filter; then add a sufficient quantity of the paint to produce a good white. I have used this varnish for about fifteen months, and find that it answers quite as well as that which is sold by the regular dealers, while the cost is less than a third of the price charged by them. The white paint may be procurred at any artists' colourman's.—*Arthur J. Doherty.*

PRIZES FOR MICROSCOPY.—At the meeting of the Royal Microscopical Society, on January 12th last, the President said that with regard to the offers of microscopical and research medals generously made by two of the members, the question had been further discussed by the Council, and as it was not free from considerable difficulty, they had decided to ask the gentlemen in question to withdraw their offers.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

J. A.—We have forwarded your letter notwithstanding it was unaccompanied by a stamp as indicated in our directions. (Vide paragraph in Notes and Queries.)

B. D.—See our reply to J. A.

C. A. S.—See our reply to J. A.

J. B.—We cannot understand why you should have any difficulty in procuring the NORTHERN MICROSCOPIST. You may obtain it from any bookseller.

T. Brittain.—Thanks for your letter containing fragment of *Merulius lacrymans* in fructification, and the other micro-fungi.

A. A. A.—Tolles' objectives may be obtained from Charles Stodder, 131, Devonshire-street, Boston, U. S. A.

A. J. Doherty.—An article on Diatoms in this number may give you the information you require.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY. The first 5 Nos. of 1880, published at 4s. each. What offers of slides? fungi preferred. "Fungus," care of Editor NORTHERN MICROSCOPIST.

TYPICAL SPECIMENS of Lichens, mounted and properly named; in exchange for typical specimens of Mosses, mounted and properly named.—Address:—"Ravenwood," care of Editor, NORTHERN MICROSCOPIST.

FOR well mounted Microscopic object of interest send other well mounted object.—Creese, Brighton Villas, Cirencester.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

FOR SALE, a half-inch objective by Dancer, with collar adjustments, will resolve angulatum. Price £2, or will exchange for a good herbarium of correctly named mosses of about 80 species and one of lichens of 100 species. "D." care of Editor NORTHERN MICROSCOPIST.

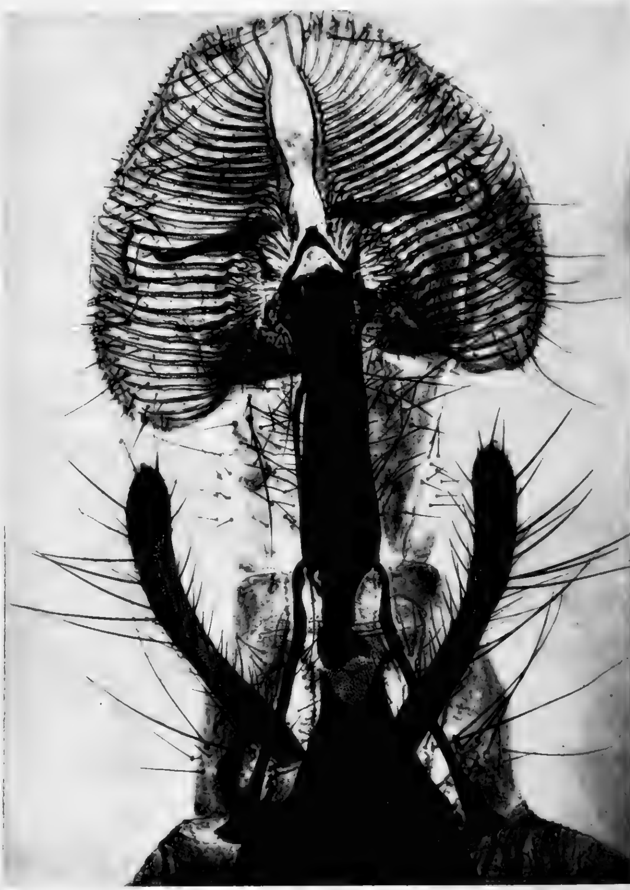
FIRST CLASS MICRO-CHEMICAL SLIDES for polariscope: 50 varieties; rare alkaloids, dichroic salts, etc. Also some foraminifera and small land molluscs. 8d. each; 7s. dozen, free. —J. H. Jennings, 14, Beech-avenue, Sherwood Rise, Nottingham.

VALLISNERIA SPIRALIS PLANTS, 8d. dozen, two dozen 1s. 2d., free.—W. Holmes, 118, Gerard-street, Derby.

A FEW DUPLICATES of Microscopical slides, well mounted. Price, 7s. per dozen; six dozen for £2.—H. Francis, 12, Sion-hill, Clifton, Bristol.

WARD'S MICHIGAN botanical series and other well mounted microscopic slides. Price, 4s. 6d. dozen. Also apparatus.—E. Clover, Springfield, Sudbury, Suffolk.

VALLISNERIA and assorted aquarium weeds, 8d. dozen, free.—Mr. Keall, Chemist, Swansea.



G.L.L. Phot. Woodburytype.

PROBOSCIS OF FLY.

THE NORTHERN MICROSCOPIST.

No. 4. APRIL. 1881.

PHOTO-MICROGRAPHY.

By George E. Davis, F.R.M.S.*

THERE is no doubt that the art of photographing microscopic objects is usually considered a difficult one, and when we are confronted with the fact that nearly all those who have written anything upon the subject have generally advised the use of a host of complicated paraphernalia, it cannot be surprising that such an opinion has gained ground.

The vast array of apparatus, condensers, blue cells, heliostats, even to the special room set apart for use as a large camera, must have been quite sufficient to cool the courage of any one with only their evenings at leisure, and to deter them from attempting to practise such a process. It is true we have several papers which have done something towards popularizing the art, such as that read before the Royal Microscopical Society on the 5th of November, 1873, by Mr. Alfred Saunders, in which many hints were given, and which probably has been of much service to beginners; but even in this paper the author observes that "artificial light is a delusion," and proceeds to plead for the use of sunlight only.

There is no doubt that the sun's rays are better than artificial light for such powers as the one-eighth objective and upwards, but for any object-glass of lower amplification, the ordinary microscope lamp or a good argand gas-lamp does as well; nay, is preferable, on account of the ease with which it may be put in use at any time, for the direct rays of the sun are not always obtainable.

A paper was read on November 19th, 1875, before the members of the Medical Microscopical Society, by Mr. G. M. Giles, in which the construction of a simple apparatus was briefly described, and in *Science Gossip* for 1876, there appeared an interesting paper from the pen of Mr. T. H. Powell, who advocated the use of a paraffin lamp. The whole communication teemed with hints

*A paper read before the Birmingham Microscopical Society, Jan. 18th, 1881, and also before the Manchester Microscopical Society, March 3rd, 1881.

calculated to save the future worker some trouble; but I must confess that the general principles of the process were but meagrely illustrated, and as the process recommended was the wet collodion one, I consider there is still room for a good practical dissertation upon the subject.

The use of photography for the purpose of delineating microscopic objects is not new. In a paper read before the Philosophical Society of Washington, U. S. A., Dr. Woodward makes allusion to several Daguerreotypes of objects taken by Prof. Draper, with a Nachet microscope, at various dates from 1851 to 1856. These were probably the first attempts at photo-micrography; and, no doubt, were very much inferior to the productions of the present day.

The most successful photographers of microscopic objects have been, Col. Woodward, Dr. Maddox, Mr. Wenham, Drs. Abercrombie and Wilson, Mr. Shadbolt, and the late Dr. Redmayne, of Bolton, some of whose pictures by the kindness of Mr. Ward, of Manchester, I am enabled to show you to-night. You will probably have noticed that photo-micrographists who use high powers generally select diatoms for their subject, and the reason of this is that being flat, the picture lies in one plane and the whole of it comes into focus at once very distinctly.

If we glance over the bibliography of our subject we shall find that most of the productions have emanated from Col. Dr. Woodward, and one of his reports to the Surgeon-General of the U. S. army and published on page 169 of Vol. VI. of the Monthly Microscopic Journal, gives the details of his process at great length. I will not trouble you by reading his method, which, no doubt, you can all see by consulting your library, and therefore pass on to the immediate subject of this paper, which is to describe a method of taking photographs of microscopic objects at any time, in any place, and with the ordinary materials found in the hands of the photographer and microscopist.

The camera employed is shown in fig. 7, and is of the structure and form I specially recommend. You will no doubt hear some quite as strongly advising the use of a bellows camera, but there are serious objections to the use of such a one when extended to four or five feet. This camera, you will observe, is made to detach from the base board, but for portability only. The base board should project for some distance in front of the camera in order to carry the microscope and illuminating apparatus. The whole should be placed upon a firm table, quite free from vibration, in order to ensure perfect sharpness of the image upon the sensitive plate. My original apparatus was of French make and of large size; but it was soon discovered that a large camera was of very little use with the foreign lenses supplied with the apparatus. After this I made one of deal, or rather a portion of one to lengthen an

ordinary $7\frac{1}{4}$ ins. × $4\frac{1}{2}$ ins. camera, with which I was enabled to take several very good pictures. Finally I have settled down to the one as shown in the illustration (Fig. 7), which was made for me by Mr. Furnivel, of 5, Kay-street, Ardwick Green, Manchester, who treats microscopic cabinet making as a speciality.

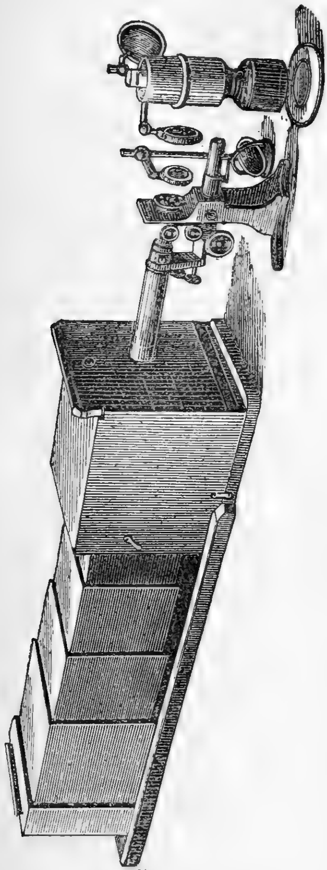


Fig. 7.

And now, perhaps, you can see the usefulness of a practical treatise on the subject; had I been able to see such a camera as this one at the outset, I should be some pounds richer, and instead of plodding along for a whole year, constantly making alterations, I might have spent the time much more profitably.

Perhaps you will be inclined to say that up to this point I have advanced nothing new, many having written on this subject; but what I wish to say most distinctly is, that it was the very existence of this literature which caused me to spend my money with such an unprofitable result.

The dark slide of the camera shown in Fig. 7 is made to take a large square plate, with carriers for any less size. The most handy dimensions, especially for the beginner, is the quarter-plate as it is termed, and measures $4\frac{1}{4} \times 3\frac{1}{4}$ inches; it is only for special purposes that it need be larger. Of course the length of the base-board and of the camera body must depend upon the degree of amplification required, and the diameters to which an object is enlarged in my own camera when the sensitive plate is at a distance of 36 inches from the object may serve as a guide in this direction.

This is when using the microscope without the eye-piece as is the general practice; but it is sometimes necessary to use this, and therefore the list of diameters so yielded, is given, and compared with the ordinary amplification at ten inches when used as a microscope merely.

Designation.	Diameters. Without Eye-piece.	With the A Eye-piece.	At 10 ins.
4 inch.........	12	36	18
2 "	21	63	32
1 "	37	110	56
$\frac{1}{2}$ "	80	240	120
$\frac{1}{4}$ "	173	520	260
$\frac{1}{8}$ "	360	1000	540
$\frac{1}{15}$ "	530	1600	800

The microscope employed may be of any ordinary kind, monocular preferably, and if provided with a means of shortening the tube or body so much the better. The tube should be lined with velvet, to prevent central flare, and the instrument provided with a coarse and fine adjustment, the latter answering the helm when turned either backwards or forwards; but more particularly must it be sensitive to very slight movements of the milled head when *withdrawing* the objective from the object.

Dr. Woodward, in his report already quoted, writes, "the objective selected should always be specially corrected for photography." I cannot agree with Dr. Woodward on this point; no doubt it is very convenient to have one so corrected, but it is by no means imperative. To those as yet uninitiated in the mysteries of the photographic art, it may be necessary to say that the *visual* and *actinic* foci often (though not necessarily) lie in different planes, and therefore an objective which gives perfect definition *to the eye*, will often produce a blurred and indistinct image upon the sensitive plate. This may be remedied by withdrawing the objective, by turning the milled head of the fine adjustment; it cannot be told beforehand what allowance is necessary, the only method is by trial and error, some objectives require no correction whatever, while others which necessitate considerable movement from the object can be made to yield just as perfect results.

The best way to arrive at the necessary correction is to take a picture at the best *visual* focus, develop, fix and dry it in the usual manner, and then withdraw the objective from the stage by means of the fine adjustment until the image appears on the ground glass about as indistinct as it does in the negative. Ordinary ground glass is too coarse to focus upon, two surfaces should be rubbed together with a little of the finest emery and water, or a focussing glass may be prepared by coating an ordinary glass plate with spirit varnish, and allowing to dry without heat, or a coating of unboiled rice starch may be applied and allowed to dry on a levelling stand. The correct focus may be obtained by the eye alone, nevertheless, it is always advisable to use a magnifier, an engraver's lens, or an ordinary eye-piece with the eye-lens removed.

Perhaps it may be useful to some of you to give the various corrections found to be necessary with several objectives in order to obtain the sharpest definition, and I may here advise all who wish to practise the art, to spare no pains in getting the sharpest definition possible, as having once obtained it, the correction will be constant for that objective. The microscope stand which I use for this work is one of Browning's, the fine adjustment withdraws the objective from the stage $\frac{1}{200}$th of an inch for each complete revolution of the milled head when the screw is in the centre of its traverse. This milled head is divided into 10 principal divisions, each of which is again separated into four.

Designation.	Maker.	Angle.	Turns.	Inches.
4 inch..............	Dancer	9°	2	$\frac{1}{100}$
2 ,, ...	,,	14°	1	$\frac{1}{200}$
1 ,, ...	Browning	25°	$\frac{1}{2}$	$\frac{1}{400}$
$\frac{1}{2}$,, ...	,,	60°	$\frac{1}{10}$	$\frac{1}{2000}$
$\frac{1}{4}$,, ...	,,	85°	$\frac{1}{40}$	$\frac{1}{8000}$
$\frac{1}{8}$,, ...	,,	140°	0	0
$\frac{1}{15}$,, ...	Dancer	170°	0	0

It has been stated by several writers on this subject that monochromatic light brings both *chemical* and *visual* foci into the same plane, and therefore no correction is required. I cannot understand how any writer can have fallen into this error, for error it is, and which a single experiment would have set right. Of course the chromatic aberration is disposed of, but we have introduced a new element into our calculations; a lens which is spherically corrected for white light is not so for monochromatic, and therefore the picture is blurred with spherical aberration.

There now remains but to describe the method of illumination: well, there is the lamp, either an ordinary thirty hole argand gas burner, the rays being manipulated with the bull's-eye condenser, or the ordinary paraffin microscope lamp of no special pattern.

The substage achromatic condenser is only used for powers of greater amplification than the half-inch, or where the camera is drawn out to a great extent. I have used several sources of illumination, sunlight, the electric light, the oxy-hydrogen lime light, the magnesium light, as well as a paraffin lamp and gas, but for general work the two last are preferable, seeing that they give nearly all the light required for medium and low powers, and if a very intense illumination is requisite, it can easily be obtained from gas or oil in such an apparatus as the Sciopticon. Dr. Carl Seiler, in a communication to the American Journal of Microscopy, p. 159, 1879, upon this subject, seems to think that wet plates are preferable to dry, and adduces arguments in support of his views. I cannot agree with him, however; dry plates are so convenient, and with good manipulation are capable of producing excellent

pictures—I ask you to examine this photograph of the blow fly's proboscis taken with one of Swan's plates, and say whether any more detail could have been shown. Look at the delicate hairs, the teeth, apply a lens to the false trachea or suctorial tubes and say whether, in your opinion, a wet plate would have shown more than this. [This photograph has been reproduced by the Woodbury type process, and is given as Plate V. in the present number.] There are many kinds of dry plates in the market which are now largely prepared from a gelatine emulsion. Of those I have tried, the preference is given to Swan's and to those made by Wratten & Wainwright. They are made up in packets of one dozen each, for which is charged three shillings if of quarter plate size, or measuring $4\frac{1}{4} \times 3\frac{1}{4}$ inches.

Do not over expose these gelatine plates, for if you do you will get nothing but thin and misty images. From some cause those exposed to gas or lamp-light do not *commence* to develop so quickly as those exposed to sunlight, but if time is given and they are not over exposed, perfect pictures may easily be obtained. The time of exposure in the camera depends upon the quality of the light, but more perhaps upon the nature of the object than anything else; for instance, the section of a kidney of a rat required twenty minutes exposure with the argand gas and bull's-eye condenser, while a crystal of glass under the same conditions of light and amplification required only three minutes.

For ascertaining the exact exposures and the corrections required for the difference in actinic and visual foci, I strongly advise the beginner to keep a bound record of his failures as well as prints from *all* his negatives, with full particulars respecting them; they are great helps in photographing new subjects.

The following actual exposures with various objects may be found useful to others, the plate being at a distance of 36 inches from the object:—

Objective.	Subject.	Exposure.	
Four-inch	Wing of Blow Fly	15	seconds.
Four-inch	Segment of Blow Fly	30	,,
Two-inch	Wing of Blow Fly	20	,,
Two-inch	Proboscis of Blow Fly	60	,,
One-inch	Wing of Blow Fly	60	,,
One-inch	Proboscis of Blow Fly	2	minutes.
Half-inch	Glass Crystal	3	,,
Half-inch	Section of Frog's Lung	20	,,
Quarter-inch	Glass Crystal	10	,,
Quarter-inch	Arachnoidiscus Ehrenbergii	12	,,
Quarter-inch	Peronospora Infestans	10	,,
Quarter-inch	Section of Pine Wood	20	,,
Eighth-inch	Cuticle of Esparto	40	,,
Eighth-inch	Pleurosigma attenuatum	40	,,

It may be thought that exposures extending over forty minutes must be inconvenient, but this is not found so in practice; the camera is left to itself, the operator returning to it when the time for complete exposure is finished.

After the sensitive plate has been exposed for the necessary length of time, it is ready for development; it is therefore taken into a room from which every trace of actinic light has been excluded, and there the picture is brought to view by the use of the developing solution. Nearly every photographic manipulator has his own way of developing, though the general principles are the same, and as I fear that every one will not agree with my method, I give that advised by Messrs Wratten & Wainwright for their instantaneous dry plates :—

STOCK SOLUTION A.*

Ammonia Liquor, *fort.* .... 1 ounce.
Potass Bromide.......................................60 grains.
Water...... .... 2 ounces.

DEVELOPER.

Pyrogallic Acid .... 6 grains.
Stock Solution A*.....................................10 drops.
Water .... 2 ounces.

Lay the exposed plate in a dish of cold water to soak while the pyrogallic acid is mixed. For each $\frac{1}{4}$ or 5×4 plate use six grains of pyro., diluted with two ounces of water. First pour off the water from the plate and apply the pyro. solution, then add five drops of "Stock Solution A*," and keep this weak developer on the plate until the highest lights are pretty well visible; then add from fifteen to twenty drops more of "A*" to finish development. By this method more of the film is employed and greater density is obtained. Whenever any of solution "A*" is to be added to the pyro. solution it should be first dropped into the developing cup, and then, if the solution which is in the dish be poured back into the cup, a perfect admixture will be the result without the necessity of stirring. With correct exposure full printing density may be easily attained with the alkaline pyro. alone. We supply no plate that will not bear *one hundred drops* of "Stock Solution A*" without fog. One thickness of deep ruby glass is *unsafe;* two, at least, are necessary. Should any discolouration of the film appear after the negative has been fixed and washed, it may be cleared away with a weak solution of perchloride of iron and water (about the colour of pale sherry), the plate afterwards to be washed thoroughly."

The image generally makes its appearance after about two minutes, and the deposit gradually increases in intensity until the development is finished; it is then to be well washed and fixed in the following solution :—

Hyposulphite of Soda.............................. 4 ounces.
Water..20 „

In cases where, from unavoidable over-exposure, it has been impossible to obtain density with the alkaline developer, a most careful washing should be given after fixing, with a view to remove the last trace of the alkali (ammonia).

Intensification can then be effected with acid pyro. and nitrate of silver, or with protosulphate of iron and nitrate of silver. We have a decided preference for the latter, and use the following formula, viz.:

A.

Protosulphate of Iron....................................15 grains.
Gelatino Acetic Acid Solution (as described below).40 drops.
Water.. 1 ounce.

B.

Nitrate of Silver..10 grains.
Acetic Acid, Glacial, 50°..................................10 drops.
Water.. 1 ounce.

The Gelatino Acetic Acid Solution is compounded as under :—
Gelatine...15 grains.
Acetic Acid, Glacial, 50°.................................. 3 drachms.
Water.. 5 „

and it is well to prepare a stock of this, and also of "A," as they are both better for keeping.

To proceed: first flood the plate with water, and then with a solution of iodine and iodide of potassium of the colour of *pale* sherry for one minute; rinse it off, and apply enough of "A" to cover the plate for about the same time. Now drop into the cup a drachm of "B," and bring "A" back from the plate to the cup to mix them together. Re-apply, and keep moving over the surface until density is sufficient. If any air-bells should occur they must be kept moving, and then they will do no harm.

Both development and intensification are best performed in a dish; the former in ebonite, the latter in porcelain.

When the plate has again become dry, warm and varnish it as usual.

Having obtained a suitable negative it is easy to print from this either upon carbon tissue or the ordinary sensitive paper, which may now be bought prepared, at one shilling per sheet. It will keep in good condition for months.

After printing several shades darker than is finally required, the prints are soaked in water to remove the free nitrate of silver, and then put to tone in the following bath :—

Chloride of Gold.......................................15 grains.
Acetate of Soda.. 1 ounce.
Water ....80 ounces.

After toning, the prints must be well washed and transferred to the fixing solution, which should be of the same strength as that used for fixing the negatives. The prints should be allowed to remain in the fixing solution for ten minutes, after which they are transferred to water where they are to be washed until perfectly freed from all traces of the hyposulphite.

There are two applications of this art I wish to mention, which may be of great utility—I refer to the preparation of wood blocks for the purpose of illustrating microscopical work, and also for the production of lantern transparencies. The greatest expense in producing good illustrations is that of the artist, but if the picture is put upon the wood the remainder of the work is cheaply and expeditiously performed. One way of doing this is to transfer an autotype carbon picture to the prepared wood block; but to produce good pictures upon wood it is better to employ the wet collodion process.

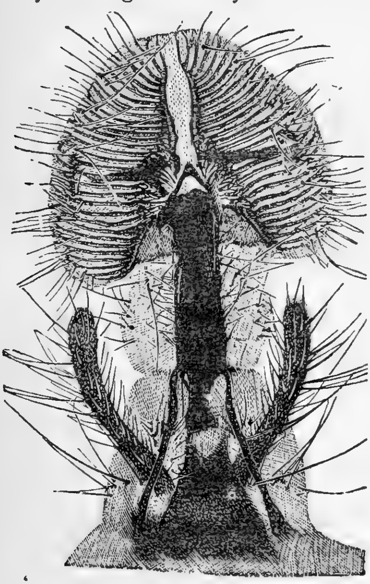


Fig. 8.

A slightly over developed positive is produced upon glass in the ordinary way, being developed with an iron developer and the film transferred to the woodblock in the following manner. The block is first to be coated with a gelatine solution made by soaking one ounce of Nelson's gelatine in nineteen ounces of water for twelve hours, dissolving with heat, and stirring in a solution of 20 grains of chrome alum in one ounce of water. When thoroughly incorporated, add sufficient lamp black to form an even black coating upon the wood.

If the block be first coated it will be dry and ready to receive the film by the time the operator has proceeded thus far. The positive having been taken, developed and fixed, a piece of gum paper is "squeegeed" to the wet film, which must then be stripped off the glass; the paper and film may now be trimmed with the scissors and brought into contact with the prepared block under water, gently squeegeed to remove air and water, and set aside for a while so that the two films may become amalgamated. After a short time the block is soaked in tepid water to remove the gummed

paper and it is then ready for the engraver. The illustration shown in fig. 8 has been prepared by the above process, from the same picture as the Woodbury type at Plate V; and also the figs. 1 and 2 in No. 1 of THE NORTHERN MICROSCOPIST, which were first photographed from the microscope by the aid of the quarter-inch objective.

TRICHINA SPIRALIS.

AT the present time there appears to be considerable excitement caused by the prevalence of trichinosis amongst the swine, which are brought from the surrounding country into Chicago as a centre, where they are killed and cured; and as pork, hams and bacon are despatched to all quarters of the globe. The matter has been deemed of so much importance that relative questions have been asked in the House of Commons as to whether the Government intend taking steps to prevent the importation of infected pork from America.

Mr. Mundella finds that we receive into this country every year from America no less than 5¼ million cwts. of pork representing a money value of 9½ million pounds sterling, and therefore the prohibition of such a vast food supply could only be justified by the most urgent necessity.

In France, Russia, Italy, Austria, Spain, Portugal and Greece the importation of American pork has been prohibited, but in these countries the inhabitants do not rely so much upon imported meats as those of the British Isles.

The Manchester Courier in an article upon the subject, a short time since pointed out that a case of urgent necessity had not then arisen, in which for want of better information we must concur though we cannot agree to the statement "that no case of trichinosis has occurred in this country," since we possess a slide labelled "Trichinæ cysts in human muscle, from Chorlton workhouse, 1872."

In France trichinosis has always been rare and exceptional, and in Germany, according to the latest statistics, it has been notably reduced since the introduction of compulsory microscopical examination. Of the 1,728,595 swine examined 800 animals were found infected, while at Lienköping in Sweden one in 63, at Copenhagen one in 465, and at Schwerin one in 550 were diseased. At Chicago, it is stated that out of 400 pigs examined 28 were infected, and Nocart and Bonley found 20 hams infested with this parasite out of 200 which had been imported into Sweden from America.

In Italy, in the month of January, 1878, a consignment of hams was received in the departments of Milan and Turin from Cincinnati, which upon microscopical examination were infected with trichinæ in the proportion of 3 in 40. Under the compulsory examination system in Germany, one in 2,000 was found infected in 1876, and one in 2,800 in 1877.

In several of the countries already mentioned, microscopical examination is very exactly and rigorously practised, and premiums ranging from 15 to 30 shillings are awarded to inspectors who

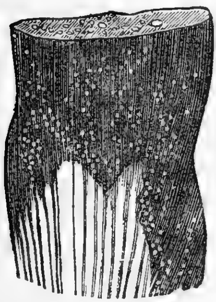


Fig. 9.

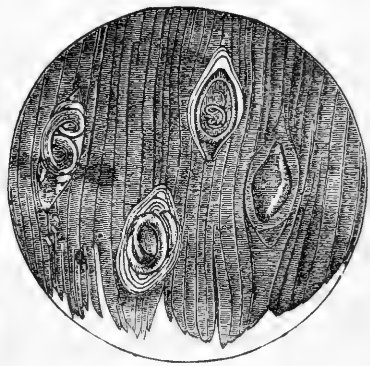


Fig. 10.

register real cases of trichinosis. In all cases of dispute the matter is referred to *savants* appointed by the Government, who have often to rectify errors of observation, notably the mistaking of vinegar eels *(Anguillula aceti)* for true *Trichinæ.*

On March 8th, in the House of Commons, the President of the Local Government Board, in reply to Dr. Farquharson, member for West Aberdeenshire, stated that in consequence of the prevalence of trichinosis in American and other hams and pork, he had directed a circular to be issued to the several sanitary authorities in the country, calling their attention to the precautions to be taken, and urging them to require of their medical officers especial vigilance in carrying out the Public Health Act.

Trichina spiralis is a species of worm of the order Cœlelmintha and family Nematoidea, and is found in the living animal in two states: first agamous and encysted in the muscles where it forms opaque white specks, and secondly, sexual and free, in the intestinal mucous. In the adult state, the male measures about $\frac{1}{25}$th of an inch in length, the female being 3 to 4 times the length of the male. The female is viviparous and very prolific, from 200 to 1000 young trichinæ having been observed within the female, and when

they have just left the body of the parent they are extremely small, measuring only about $\frac{1}{8000}$th of an inch in length. The parasite is cylindrical and narrowed towards the anterior end, the posterior end being obtuse and rounded. Fig 9 is an illustration of a muscular bundle infested with trichinæ, which are shown of their natural size as small white spots, while a section of the same magnified 30 diameters is shown in Fig. 10.

In the agamous state the worm is coiled upon itself in its cyst, over which there has been some amount of discussion. This cyst, or larval chamber, grits under the section knife, and dissolves in hydrochloric acid without effervescence, and therefore, according to Bristowe and Rainey, consist of phosphate of lime; Küchenmeister, on the other hand, holds that they are formed of carbonate of lime; while Davaine bringing his experience to bear upon the matter, though stating that the absence of effervescence is no proof of the absence of carbonic acid, since the small quantity which is evolved might remain dissolved in the surrounding liquid, hints that carbonate of lime might be a normal constituent of the cavity of the cyst.

When the agamous state present in the muscle of a pig is introduced into the alimentary canal of the human economy, the immature worms escape from their cysts, develop their sexual organs, and produce young at a very rapid rate; the new generation piercing the walls of the digestive system, enter the muscles where they become encysted.

The vital resistance of *Trichina spiralis* is very considerable. It will live in cancerous tissue, and when plunged into a freezing mixture maintained at —20° C (—4° F.) they have been found alive after 72 hours. Protected by their cyst they require a temperature of 70°—75° C (158—167° F) to kill them; while when heated to 60° C (140° F) in the muscular fibre they become very lively. Deprived of their protecting cyst and submitted to a temperature of 67° C (153° F) they still move, and when meat infected with trichinæ has been buried and in putrefaction for over five days, they have still been found living.

In Germany, microscopes are made specially for Trichinal observations; several were described in the August number of the Journal of the R.M.S.; but any good firm microscope stand with a mechanical stage, so that it may be used in such wise as not to miss any part of the object during the search, is sufficient for the purpose. Armed with a double nose piece, and good objectives of 1″ and ¼″ power, together with an extra large and strong compressorium, the observer should be able to detect trichinæ without mistake.

It is necessary to examine fragments and sections of those muscles which are most frequently attacked, the latter can be cut with a Valentin's knife when the substance is not too hard and dry.

The muscles of the diaphragm, the laryngeal muscles, the muscles of the fore-arm and leg, the intercostal muscles, and the massateric muscle, from all of which by the aid of the dissecting (curved) scissors or knife thin slices must be cut in the direction of the fibrils. The slices must then be put in the centre of a drop of water upon the glass plate of a strong compressorium teased out with needles moistened with acetic acid and glycerine, covered with the top glass of the compressorium, and placed upon the stage of the microscope. If trichinæ are present they will be recognised as pale ovoid swellings situated between the muscular fibres; these are the cysts in the interior of which the worms are coiled up.

M. Tikhomiroff, a Russian *savant*, has described a method for the disintegration of muscular fibre for facilitating searches for trichinæ. The suspected meat is cut into small pieces and digested for half an hour in a mixture of one part of nitric acid and one part of chlorate of potash; upon transferring to distilled water and agitating with force the muscle splits up into very fine fibres, on some of which the fusiform swellings of the encysted trichinæ are easily perceptible if present. The last method is not recommended, although in good hands it might yield excellent results, still the mixture of nitric acid with chlorate of potash is an exceedingly corrosive fluid, and even explosive under certain conditions, and consequently should be used with great caution.

AN INTRODUCTION TO THE STUDY OF LICHENS.

BY THE REV. W. JOHNSON.

THE group of Plants, which is to occupy our consideration in this paper, has until recently, been regarded as the "approbria" of our Cryptogamic Flora; and these humble members of the vegetable kingdom may still be so regarded by many people. But, when we become acquainted with the Lichens, when we take time to behold their hidden beauty, to understand their structure, their habits, uses, and modes of growth; when we feel the thrill of enthusiasm which they can impart, and when the frail things, dried in the herbarium, gather around themselves some of the sweetest associations of our life—associations redolent of the woods, the heaths, the mountains, and the shore; then, disregard of them, much more despising them, becomes a matter of surprise. Disregard, or despicable feelings in relation to Lichens, may arise from ignorance; but they cannot arise from any lack in the plants themselves of those qualities which create and sustain interest; nor,

from any surrounding difficulties which are insuperable to a pleasant, profitable, and useful study of them. There are difficulties in the study of Lichens, and perhaps, some which are peculiar; but, as in all things else, an unenlightened imagination magnifies them. The chief obstacles here are two. These are the terminology and the determination, or the distinction of the species and varieties. The first is the common tax of knowledge in all her departments. You must master the phraseology before you can know the subject. The second is a difficulty which now, when it is the greatest on account of the many forms discovered the differences of which are small; yet, it is the more easily overcome, because, the very growth of our Lichen-flora has resulted in a more natural and comprehensive classification, as well as in a better and more certain method of study. As, in other departments of Nature, the microscope has here come to our aid; and now, by comparing the internal structure; the shape, size, and colour of the spores, with the outward features of the plant, the determination of species is more easily and correctly attained, than when such determination was made simply by observing the external characteristics alone. Beyond these two checks, the path in lichenology is comparatively smooth, and abundantly healthful and enjoyable.

Lichens, are a class of plants in the secondary division of the vegetable kingdom. They belong to the Cryptogamia or flowerless plants. Their position in that division is between the fungi on the one hand, and the algæ on the other. The difference between the Lichens and those two adjoining classes, is not so great that their boundaries are unquestioned. Nor yet, are their affinities so close that the Lichens are not clearly distinguished between the two. Nature has no sharp and fast lines in her divisions. Her boundaries generally overlap, and it is so here. The Lichens run into the fungi in the corticulose Verrucareæ, and into the algæ in the gelatinous Collemacei. In a new text book on Botany,* recently translated into our language, Lichens are no longer regarded as having a distinctive existence. Their position as a separate class of plants is spoken of as a thing of the past. They are here placed in the order of Ascomycetes, amongst the Fungi. This new departure in relation to Lichens, which, to say the least of it, is somewhat presumptuous as well as premature; is founded upon a theory propounded by Schwendener some few years ago, and now well known amongst lichenologists as the "Schwendenerian Theory." Briefly expressed, this theory is that—Lichens are not autonomous plants; not individuals, in the ordinary sense of the word, but a compound of filamentous hyphæ of the fungi and the green matter of the algæ. The medulla of the Lichen, is the sup-

*Text Book of Botany. Prank & Vines, 1880.

posed fungus; and the coloured gonidia which are found in Lichens, the supposed algæ. The fungus is said to be parasitic upon the green cells of the algæ, holding them as prisoners and slaves, and by their activity nourishing its own growth. We cannot discuss this theory here; nor would it be prudent to enter into it in any large way. But, we may remark upon it, that, supposing Schwendener's hypothesis were true, still, the Lichen would be a distinct plant, and would have a claim to be so recognised. Inasmuch, as the supposed fungi and algæ combined, produce a plant differing from either of themselves, and which could not exist if they were separate; also, if either the green cells, or the hypha, produce the one or the other, then they are no longer either algæ or fungi; for a true alga does not grow fungal hyphæ, nor does a true fungus produce green algal cells. But the Lichen has its own independent characteristics, independent either of fungi or algæ. It has its own distinct and definite forms, its own habits of life, its own organs of self-propagation; and if fungi and algæ were by some means obliterated from the earth, so far as their presence is concerned, Lichens would continue to flourish just the same. But further, most, or all our leading lichenologists are against this dual-hypothesis of Schwendener. This does not prove the theory untrue we know; but it is a fact which carries great weight, when we reflect that they who have made Lichens a special and a life study, must be allowed to be as well or better acquainted with them than men whose investigations have for their object merely the founding or the support of a theory. Dr. Nylander, than whom does not live a greater authority on Lichens, by his own investigations and from his own knowledge, has repeatedly shown the absurdity of Schwendener's theory; and he speaks of it as "that hypothesis which none indeed, but tyros can patronise." "An hypothesis informal and absurd, supported by no serious observations." As to how Lichens shall be regarded anent this hypothesis, Mr. Bentham considers that "whatever be the result, the group of Lichens is so distinct in its negative characters, and at the same time so extensive and varied a one, that it seems more methodical to treat it, as heretofore, as a distinct class, than to absorb it in that of fungi, notwithstanding the close affinity shown by its reproductive organs." In as brief a manner, as is consistent with clearness, we shall now endeavour to give some description of the Lichen organism, with some reference to its habits and uses; and then, drop a few hints relative to the study of this group of plants. The Lichen, as a plant, has no axis, either ascending or descending; no branches or leaves, in the same sense as phenogamous plants. Its nearest approach to a leaf can only be called a lobed or *laciniated* frond. Its vegetative or expansive portion, is denominated a thallus. (Gr. *thăllŏs*, a young shoot or frond). The

thallus may be said to comprehend the whole plant, inasmuch as it contains within its tissues, or bears upon its surface the reproductive organs, both male and female, with their fruit. The form which the thallus assumes in growth, is very variable. So is its consistence, size, and colour. It will sometimes expand to one or two feet in diameter; while, in other forms, it will present a small grey or coloured spot; and often nothing but the fruit will be seen, the thallus being evanescent. The typical forms of the thallus are *vertical* and *horizontal.* The vertical, or free thallus, is divided into *fruticulose* and *filamentous.* The former is a shrub-like aggre-

Fig. 11.

gation of segments or portions, springing from a centre; and they are either narrow or broad, round or compressed, simple or branched. Cladonia and Ramalina are fruticulose forms. The *filamentous* species are more elongated than the fruticulose. They are round and thread-like, more or less clothed with divergent fibrils. *Usnea barbata* (fig. 11,) shows this form of Lichen.

The forms of Lichens just named, are those which give the aged and venerable appearance to many of our forest trees; and present them to our sight so shaggy and hoary, as almost to move our pity, while they command our reverence. Wordsworth's "Thorn" must have been covered with these Lichens. He tells us:—

"There is a Thorn, it looks so old,
In truth you'd find it hard to say
How it could ever have been young,
It looks so old and grey.

* * * *

Like rock or stone, it is o'ergrown
With lichens to the very top,
And hung with heavy tufts of moss,
A melancholy crop."

The horizontal thallus embraces the *crustaceous* and the *foliaceous* species. The crustaceous (fig. 12,) predominates in number over

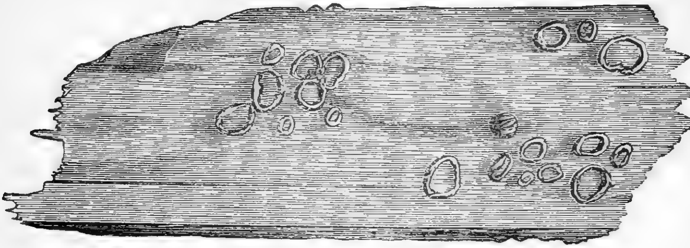


Fig. 12.

all other forms. It closely adheres to the surface on which it grows. In growing, it sometimes assumes a determinate shape, and has a distinct margin when it is called *determinate* or *uniform.* When it spreads itself irregularly it is said to be *effuse.* The thickness of the thallus, and the condition of its surface, show many modifications; which are all considered in the distinguishing of species. The *foliaceous* or *frondose* thallus is the most leaf-like of all lichen-growths, and is considered by some as the highest lichen development. It is a flat, light grey or green expansion. Its margin varies in different species. Sometimes they are irregularly torn into lobes or *lacerated*, sometimes the lobes are *crenate* or *sinuate*, and upturned. The margins or lobes are at other times cut into *laciniæ*, these are narrow and linear, or sinuate segments. The foliaceous thallus is most frequently green above, and light or dark coloured beneath. On the under side it is sometimes villose, or else has a number of short fibres or bundles of fibres called *rhizinæ.* These have the appearance of small rootlets, but do not act as such; they simply fix the plant to the matrix or place of growth. Within these general distinctions, the Lichens show many features and variations, some of which are characteristic and permanent, others dependent and changing. But these can only be understood by the initiated, yet they are gradually and soon learned by the careful and diligent student.

The structure of the lichen thallus is much alike in all forms; but there is a difference between the gelatinous family, and the rest. In the large family of Lichenacei or non-gelatinous plants, the thallus is almost invariably stratified, and consists of three distinct layers of cellular tissue. But in the family of Collemacei, while there are found the three forms of tissue just referred to, yet they are not stratified. The hyphoid and green cells being mingled together throughout the thallus. In one branch of this family—the Collemas, there is no distinct cortical layer. Another point of this difference between these two families, is observed in the

arrangement of the gonidial cells. In the non-gelatinous plants, the green cells are generally free, but in many of the Collemas, they are joined together in a moniliform manner, or in the fashion of beads on a string. In some members of the family they are diffused through the thallus, while in a few others they are grouped into small series of cells.

(To be concluded in our next.)

OUR BOOK SHELF.

A Biological Atlas. D. M'ALPINE, F.C.S., etc., and A. N. M'ALPINE, B.Sc. Edinburgh and London: W. & A. K. Johnston. 1880. 423 colored figures and diagrams, and 49 pages of text.

It has been our aim in previous numbers of this Journal to point out to the possessors of microscopes how good and profitable work may be done with them, and instead of ranging over the whole field of microscopy, how we may become useful in our generation by settling down to the serious study of one or two particular branches.

There is no reason why anyone should not become *generally* acquainted with nearly every branch of microscopy, but he will find it almost impossible to go into the details of each department; as the practical work required in such a case would be simply enormous. There is no doubt that the mere student is often perplexed as to what subject he shall pursue, and if a theme of no great difficulty were presented to him, with an outline of the manner in which it should be performed, a long road into the mysteries of this fascinating science would be opened up.

The above sentiment induces us to introduce to the favourable notice of our readers the foregoing Biological Atlas which has been sent us for review. Its price is low and the whole matter so pre-eminently practical that even the veriest tyro should find no difficulty in understanding it. The subjects are arranged in the order of gradually increasing development and consequent difficulty. The plates are colored, which not merely adds to the scenic effect, but enables one to see at a glance what the diagram is intended to exhibit.

Take for instance Plate III. whereon are delineated *Protococcus pluvialis* and *P. vulgaris*—there is the resting spore of this latter species showing in a very clear manner the cell-wall and the chlorophyll-containing protoplasm. By the side of this is figured

another cell which has been treated with iodine, whereby the protoplasm has been stained yellow, the nucleus being distinctly exhibited. A third figure shows the effect of iodine and sulphuric acid combined, under which reagents the cell-wall becomes blue and the protoplasm coagulated, while another cell having been treated with potash is shown empty, the alkaline solution having dissolved the albumenoid contents.

This differentiation of tissues by the aid of certain chemical reagents is most valuable in its applications to microscopical research, and the sooner the student appreciates the fact that the mere placing of an object upon the stage of the instrument and looking down the tube upon it, is not of much practical value, the better it will be, not for himself only, but for the interests of that science to which he essays to devote himself.

It is not only amongst the Protophytes that the excellent illustrations will aid the beginner. Plate VIII. is devoted to the Histology of flowering plants and from it may be learnt the value of double and treble staining. Passing now to the animal world we find Plate IX. devoted to *Amœba* and *Vorticella*, and upon Plate X. *Hydra viridis* and *H. fusca*, all of which are within the reach of almost anyone.

Higher up in the scale of life we have illustrations of dissections from the earth-worm *(Lumbricus terrestris)*, the lobster *(Homarus vulgaris)*, the crayfish *(Astacus fluviatilis)*, the fresh-water mussel *(Anodonta cygnea)*, the edible snail *(Helix pomatia)*, winding up with a set of dissections from *Rana esculenta*, the edible frog.

We cannot speak of the work but in terms of praise, and we hope that through the medium of this notice it may find its way into the hands of those who have microscopes lying idle.

NORTHERN SOCIETIES.

BOLTON Microscopical Society. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER Natural Science Association. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER Microscopical Society. Hon. Sec.: Mr. M. H. Stiles. Meets on March 6th and 20th.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL Microscopical Society. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER Microscopical Society. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER Cryptogamic Society meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER Science Association. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. North of England Microscopical Society. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S., R.C.S.

SHEFFIELD. No Microscopical Society in existence.

NOTICES OF MEETINGS.

BOLTON MICROSCOPICAL SOCIETY.—The March Meeting of this Society was held on Friday, March the 11th, C. L. Jackson, Esq., F.R.M.S., F.L.S., being in the chair. It was unanimously agreed to augment the slides in the Society's Cabinet by the addition of 48 choice slides of Diatoms.

Mr. Hall, Wharfe Foundry, Bolton, having been previously nominated, was elected an associate of the Society.

Mr. Walmsley, Treasurer, distributed a quantity of a metallic effloresence, obtained from a coal mine, evidently containing a considerable quantity of metallic iron.

After the general business of the Society had been transacted, the meeting resolved itself into a Conversazione, when the following subjects were illustrated :—

Algæ	Mr. Shipperbottom.
Circulation in *Salmo salar*	Mr. Jackson.
Parasite of Pike	,, ,,
Whelk's Eggs	,, ,,
Dr. Leidy's Work, "American Rhizopods"	,, ,,
Limnias ceratophylli.	,, Rideout.
Hydra vulgaris	,, ,,

It is an encouraging fact that a paper is in preparation for each meeting until November, Messrs. Hardman, Harwood, Jackson, Rennington, and Rideout being amongst the contributors.

The excellent demonstration on "Mounting Objects for the Microscope," given by the President (C. L. Jackson, Esq.,) at the February Meeting, has had the effect of inducing several of the junior members to commence preparing their own objects, and some very successful work has been done.

LIVERPOOL MICROSCOPICAL SOCIETY.—The Third Meeting of the present Session was held at the Royal Institution, Colquitt Street, on Friday, March 4th, 1881. Dr. Hicks, Vice-President, in the chair. Six slides for the Society's Cabinet were presented by Mr. J. M. Williams.

A paper on "Coloured Rains," with a special instance from China Microscopically analysed, and specimens of the soil after evaporation, by Rev. W. H. Dallinger, F.R.S., F.R.M.S., was read by the Hon. Sec., Mr. I. C. Thomson, F.R.M.S., in the unavoidable absence of Mr. Dallinger, at the conclusion of which, the Meeting was resolved into a Conversazione, when the following subjects were exhibited :—

Aphis found on Crocus	I. C. Thomson.
Argulus foliaceus	Dr. McClelland.
Bacterium termo, and *Spirillum undula*	H. R. Boult.
Embryo Chick, monstrosity in	Dr. Hicks.
Floscularia ornata	William Oelrichs.
Fungi, microscopic	Rev. W. Banister.

Nassula elegans and other Infusoria ....Joseph Wall.
Pollens, various ....T. C. Ryley.
Pond Life...H. M. Bennett.
Do. ....John Vicars.
Proboscis of Blowfly ....Robert Nicholson.
Smut on Oats ....W. Prior Christian.
Spines of Echinus ....Tapley Bacon.
Spirogyra nitida, in conjugation.........................George Thomas.
Wing of Burnet Moth......................................A. T. Smith, Jun.

MANCHESTER CRYPTOGAMIC SOCIETY.—Feb 21st, Dr. Carrington, F.R.S.E., in the chair. After the previous minutes had been confirmed, Dr. Carrington wished to correct an error in the description having reference to the fertile specimens of *Radula Moorei* which he brought before the notice of the Society at the last meeting.

Mr. W. H. Pearson exhibited specimens and drawings of *Radula commutata* of Gottsche's *M.S.S.*; a species new to Britain. Specimens of this species had been collected some time ago by A. Croal, but the specimens then exhibited had been collected in July last by G. A. Holt, in the Breadalbane Mountains, but had not hitherto been recognised as *Radula commutata* until a recent examination made by himself.

Specimens of *Lepidozia reptans* were referred to in Carrington and Pearson's *Hepaticæ Britannicæ Exsiccatæ* (which lay on the table), Dr. Carrington pointing out that the particular specimen from Tyn-y-Croes had been recognised by Dr. Spence as distinct from *Lepidozia reptans*, he having examined specimens which had been specially sent to him for that purpose, by Mr. Pearson, and which he now named *Lepidozia Pearsoni*.

The examination of a portion of Austin's collection of American mosses which had been brought by Capt. P. G. Cunliffe, occupied the rest of the evening. A further examination will be made on a future occasion.

MANCHESTER MICROSCOPICAL SOCIETY.—The ordinary meeting of the Society was held at the Mechanics' Institution, on Thursday evening, March 3rd. There was a good attendance.

John Boyd, Esq., the president, in opening the business of the meeting, congratulated the members on the successful issue of the Soiree.

Mr. Brittain, one of the vice-presidents, gave a short paper on the lichen *Verrucaria nitida*. The paper was illustrated by large drawings of the various organs prepared for the purpose of this paper by the Lecturer.

Mr. Boyd made a short communication on a parasite from the skin of man, *Demodex folliculorum;* this was also illustrated by a diagram prepared by Mr. Boyd.

Mr. Miles called attention to a slide of the decolored leaf of an insectiverous plant *Pinguicula vulgaris*, shewing the insect infolded and partially digested.

Mr. Lofthouse remarked that *Lepisma saccharina* might be profitably studied by beginners in microscopy, especially having regard to the scales of the insect, as furnishing capital practice in illumination.

Mr. Brittain then made a communication with regard to a new portable microscope, which, with a good French triplet, could be purchased for three guineas.

Mr. E. Ward exhibited a similar instrument, and, later on, with a Zeiss D (one-sixth) attached, shewed up well the striated muscular fibre of the cockroach.

Mr. J. Brown also brought before the notice of the members a pocket microscope slightly differing in make from the former, but well adapted for the purpose.

Mr. Mestayer asked for information with regard to the vibrating molecules

in a slide of Gamboge, mounted in August, 1866. Mr. G. E. Davis replied by giving a summary of what had been read in a paper before the Royal Microscopical Society. Mr. Chadwick and the President also took part in the discussion.

Mr. George E. Davis, F.R.M.S., one of the vice-presidents, then read a valuable and interesting paper on Photo-Micrography, which was illustrated by numerous photo-micrographs, glass crystals, *Arachnoidiscus Ehrenbergii*, *Gyrosigma attenuatum*, *Peronospora infestans*, and a section of coniferous wood *(Pinus pinaster)*, all photographed with the quarter-inch objective; a glass crystal and the cuticle of Esparto Grass *(Macrochloa tenacissima)*, taken with the one-eighth-inch objective; and several others taken with the half and one inch. Mr. Davis also took an enlarged picture of the proboscis of a blow fly before the members to further illustrate his paper.

After the reading of the paper, a discussion followed, and information on various points was elicited from the Lecturer; Messrs. Doherty, Blackburn, Hall, Dearden, and Cook, took part. The meeting then resolved itself into a conversazione, when various and interesting objects were exhibited by many of the members by means of their microscopes. The following gentlemen assisted, and during the evening were shewn :—

Demodex folliculorum..The President.
Pinguicula vulgaris, with the insect in situ...........Mr. J. W. Miles.
Hairs on the leaf of *Deutzia gracilis*..
Spores of Bramble brand in Glycerine.................Mr. J. C. Brown.
,, ,, ,, Balsam.................... ,, ,,
Fungus from Dung, *Ascobolus furfuraceus*........... ,, ,,
Transverse section of the Tongue of Cat, injected and stained, shewing papillary blood vessels...............................Mr. J. Pettigrew.
Spiculæ from oral integument of the Common Sea Urchin (*Echinus miliaris*)..Mr. H. C. Chadwick.
Larvæ of the Gnat...Mr. Thompstone.
Phascum serratum ....Mr. Stanley.
New Folding Microscope, with muscular fibre of Cockroach, shewn with a Zeiss D..Mr. E. Ward.
Vibrating molecules in Gamboge............................Mr. Mestayer.
Scales *Lepisma saccharina*...................................Mr. Lofthouse.
Brittle Star *Ophiocoma neglecta*............................ ,,
Star Fish *Asterias*... ,,

MANCHESTER MICROSCOPICAL SOCIETY ANNUAL SOIREE.—The annual soirée of the Manchester Microscopical Society took place in the Lecture Hall of the Athenæum, on Saturday evening, February 26th. The members exhibited, by means of microscopes, which were placed on tables, arranged around the room, a variety of objects illustrative of pond life, and other branches of the animal and vegetable world, as well as preparations from the mineral kingdom. There were present a large number of members and friends. During the evening the Rev. J. G. Wood, M.A., delivered a lecture on Unappreciated Insects.

Mr. Wood said the subject was a wide one, because he did not believe any insect was really appreciated. Appreciation depended entirely upon knowledge. He believed it was an absolute fact that there was no insect, however insignificant it might appear, or however noxious we might think it, which was not directly or indirectly a benefactor to mankind. He should choose one or two of the commonest of our British insects, which we are apt to call noxious because we do not understand them, and having succeeded in showing that they serve to prepare the earth for the existence of man, he thought it would be fair to conclude that the same was the case with the whole of the insect tribes. He would select an insect which is well known to many of us, and is not

appreciated—he meant the cockroach. He could not imagine why it should not be appreciated, and he did not see that there is anything in it to make it either feared or disliked. Alluding to the manner in which the cockroach is conveyed into houses, he said in nine cases out of ten it is taken in the laundry basket, in bundles of firewood and various other ways, and it is impossible to keep it out. One of the difficulties in extirpating it when it got into a house was that the eggs could not be very well destroyed. Insects were put into this world for the purpose of eating, and to do that alone the cockroach exists. To avoid them we should not waste any food, we should not have moist floors, and there should be no holes or creaks. The disagreeable ways of the cockroach, he contended, were simply a matter of taste; there are others quite as disagreeable to the insect. Moreover it is distinctly a benefactor to mankind, because it consumes the food that we waste, thereby saving us from miasma and many other evils, and it destroys bedroom vermin. Coming to the earwig, which is so called because of the similarity of its wings to the human ear, he said it does no harm at all. Some people thought it was created for the purpose of destroying their prize flowers. It only goes into the flower for shelter, and it lives on the larvæ of wasps and bees. Speaking of the common gnat, he remarked that during its life in the water it consumes certain animal and vegetable matter, which if not so disposed of would, with the warmth of the sun, produce gases productive of ague and asthma. We should be careful of calling any creature noxious, and he himself was very cautious of killing creatures the habits of which he had not studied, because he might be destroying a benefactor thinking it to be an enemy. He urged upon all the necessity of knowing all about an insect before killing it. The lecture, which was frequently applauded by the audience, was illustrated by means of chalk sketches of the insects mentioned, produced by Mr. Wood on a large sheet of black canvas.

Mr. John Boyd, the president of the society, moved a vote of thanks to Mr. Wood for his lecture.

Professor Williamson, seconded the proposition. He said it gave him great pleasure to perform this duty, although he was sorry to state that he was not a member of this association. He had been long familiar with Mr. Wood by his distinguished lectures and as a writer on various subjects, and nothing gave him more pleasure for a considerable time than the honour of meeting him there that evening. He thought all would agree with him that they had really had that evening a perfect specimen of what a popular lecture ought to be. (Hear, hear.)

The motion was carried with acclamation.

MICROSCOPICAL ANNUAL MEETING.—The annual meeting of the Manchester Microscopical Society was held at the Mechanics' Institution on Thursday night, February 24th. Dr. John Tatham, the president, occupied the chair. There was a good attendance of members.

Mr. John Boyd, a member of the council, officiated as secretary, and read the report for the past year. It stated that although the Society had only reached its first birthday, the committee felt that they could candidly congratulate the members on the vigorous and healthy condition of the association. Previous to December, 1879, there was not in this city a society of a purely microscopical character, although several societies included to some extent in their membership students who used this instrument. Some of those present would remember the meeting held in that building attended by twenty-seven gentlemen, when it was determined to start this society. Since then the society had progressed rapidly; numbers of good workers flocked to the standard, and the result was that the roll now numbered 148 members. A very useful section of the society had been the mounting class, the average attendance at which had been about twelve. From the treasurer's report the members would see that their finances were in a healthy condition, a very satisfactory result,

considering the smallness of their subscription. The accounts were only made up to December 31st, and although about twenty shillings on the wrong side, the subscriptions which were then due had since been paid, and really placed them with a balance in hand at present. (Hear, hear.) At the last eleven meetings the average attendance had been fifty-eight.

The report and accounts were adopted, on the proposition of Mr. George E. Davis, seconded by Mr. Thomas Brittain.

The following officers were then elected for the ensuing year:—President, Mr. John Boyd; vice-presidents, Messrs. Thomas Brittain, George E. Davis, Dr. Samuelson, and Dr. John Tatham; treasurer, W. W. Dawson; librarian, J. C. P. Brown; curator, F. J. Randall; committee, W. Blackburn, Henry Champ, J. W. Dunkerley, John Dutton, Henry Hall, H. Hyde, F. W. Lean, J. L. W. Miles, E. Ward, and J. Pettigrew; secretary, Charles L. Cook. The chair having been vacated by Dr. Tatham, it was taken by the new president.

Mr. John Boyd, who said the society had hope of a good session in the coming year, for already no fewer than four papers or communications had been promised. This augured well. (Hear, hear.) Last year they started very badly, there being two meetings at which no papers were read. He appealed to each member to bring forward as many short communications as possible; it should be the ambition of every individual to prepare subjects, and not, like a sponge, suck information in, but they should be prepared to give information as well.

MANCHESTER SCIENCE ASSOCIATION.—The ordinary fortnightly meeting of the above society was held in the Memorial Hall, Albert Square, on Tuesday, February 22nd, when an efficient paper was read by Mr. Henry Hall, entitled "Insect Life—The Caterpillar." Opening the subject with a sketch of the part that insects in general play in the economy of Nature, the essayist proceeded to the most important branch of his subject, viz., the habits and anatomy of the caterpillar, of which he has for some time made a study. He said, the mouth is furnished with an upper and a broad under lip, the upper is a horny plate attached to the head by an elastic membrane, that allows the creature to raise and depress it at pleasure. The under lip is broad, fleshy and thick; it is furnished outside with two pairs of jointed palpi, the outermost pair are large at the base, terminating with three small ones on each side, like the fingers on one's hand; next a very small single-jointed pair are situated just under the centre outside edge of the lip, and a somewhat large pair are fixed to the base of the chin. A third pair may also be found on each of the jaws attached to the head that are somewhat analagous to the antennæ on the perfect insect. All these palpi terminate with a long stiff bristle or hair appendage running to a fine point, and all together these feelers must be of material importance to the insect in search of food. At the centre tip of this lip, upon pressure being applied, a very fine delicate membrane protrudes, which may possibly be an organ of taste or possibly a lancet. All round, and continuing some distance inside the mouth, is studded with spines or teeth, there being no tongue, these spines are evidently intended to assist in the grinding of the food, or to catch the particles as they fall from the jaws, and these pass then into the throat and stomach. Its jaws, situated on each side of the mouth, consist of two strong, solid horny mandibles, hooked and toothed, and semi-circular in form, hollow on the inside with an additional tooth in the centre, these jaws move horizontally and overlap each other. The eyes are simple, and twelve in number, six on each side. The skin is composed of a double series of half-rings, connected along the sides by an elastic membrane. The legs are six perfect ones, and in most species there are ten pro-legs. The perfect leg has four distinct joints, the last one having a strong horny hook-claw. The pro-legs are oval and hollow, their outer margin being thickly studded with hooklets, in the centre a

clear vescicle or bladder protrudes. They breathe by means of spiracles and their trachea are exceedingly well developed. Their muscles are immensely numerous and strong, and which are capable of sustaining the caterpillar erect, like a dead twig. Their internal organs are very perfect, and the circulation of the blood is a very beautiful sight. The paper was illustrated by several well mounted slides representing the different organs mentioned by Mr. Hall, and were shown under the instruments of the various members present.

NORTH OF ENGLAND MICROSCOPICAL SOCIETY. — The monthly meeting of this society was held in the Patents Room of the Literary and Philosophical Institution, on Wednesday evening, March 16th, Mr. John Brown, vice-president, in the chair. The meeting was somewhat crowded, many visitors—ladies and gentlemen—being present. After the minutes of last meeting had been read and confirmed, and other preliminary business completed, Mr. Mason Watson read a lengthy paper by Dr. Lionel Beale, previously published in the "Journal of the Royal Microscopical Society," while Dr. Beale was president of that society, which seems intended as a counterpoise to the more advanced theories of evolution. Examples of diseased hams, taken from those to which Mr. John Milbourne, of this town, has recently called public attention, were examined, and the abundant *Cysticerci* noted *in situ*. The smoked hams in question were German (Westphalian), and not American produce. This disorder can readily be seen, the "measles," measuring in length about 1-5th, and in breadth at the widest part 1-10th of an inch; it has probably been known from time immemorial, and there is little doubt but that it is coeval with the porcine race itself. If swallowed by a suitable host, the contents of the cyst developes a *Tænia*. The occurrence of such a badly infested case must be rare and exceptional. The death point of these organisms is much below the temperature of boiling water; hence they can only be dangerous if meat is insufficiently cooked. No dread of them need exist in the public mind if this will be properly attended to, even were the disease a common one, which it certainly is not in England. Nevertheless, a too intimate acquaintance with Mr. Milbourne's parasitic messmates is not at all desirable. In illustration, Messrs. George Harkus, Mason Watson, and J. Brown, sen., exhibited *Trichina spiralis* in human tissues. Four of these examples of German preparations were kindly sent for observation by Mr. B. J. Sutherland; Mr. M. H. Robson (hon secretary), *Cysticerci* extracted from ham in question; Mr. Joseph Craggs some object dissected, and shewing hooklets; Mr. T. H. Swallow, an intestinal parasite of pig—*Strongylus paradoxus*. Mr. Swallow presented the society with two dozen preparations of microfungi, beautifully mounted by himself, for which he received the thanks of the meeting.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.— The usual monthly meeting of this society was held on Thursday Evening, March 3rd, at the chambers of the Hon. Secretary, Mr. I. Renshaw, L.D.S., R.C.S., Rochdale, Mr. Councillor J. S. Hudson, one of the vice-presidents, in the chair. There was a very good attendance. The minutes of the last meeting were read and confirmed, and several new members were nominated.

Mr. Joseph Astin gave an address on the Microscope and the various methods of illumination, with diagrams; which was listened to with great attention. He described the principles of the different powers used with the microscope, and shewed the advantages and disadvantages of different combinations of lenses. He also demonstrated the effects produced by the various methods of transmitting light to an object, shewing how certain definitions may be obtained, differing in excellence and character, by using the different reflectors, condensers and lenses. He also shewed how to make a spot lens, by fixing a small disc of dead black paper on the flat surface of the

bull's eye condenser, and demonstrated how to adjust the bull's eye condenser as an Amici prism, to shew the striations of diatoms. By this means *P. Angulatum* may be resolved by a ¼ in. of 60 degrees, and the A eyepiece. He described how the various methods of illumination might be obtained by means of cheap appliances, almost as accurately as by the most expensive sub-stage accessories. The objects shewn were

Foraminifera (rare forms of.) Transparent. Illuminated with Bull's-Eye Condenser as spot lens ....

Paramecium aurelia, illuminated with spot lens, shewing only very slight difference in the power of illumination as compared with the above ....

Pleurosigma angulatum, Resolved under ¼ in. objective, with the light transmitted obliquely ....

Foraminfera. Arranged in symmetrical groups. Opaque. The light from the lamp being transmitted through two bull's eye condensers. By this means a more intense illumination is obtained..............

Dr. A. Welsh exhibited an improved live cage, in two sections, designed and made by Mr. Spencer Smithson, of Facit.

A vote of thanks to the hon. secretary for the use of his rooms brought the meeting to a close.

NOTES AND QUERIES.

Pond Life.—Will some reader kindly inform me where likely ponds for good finds are situate in or near Manchester? and what is the most convenient form of case in which to carry a collecting bottle?—*B.*

Dark Ground Illumination.—In reply to *W.*, he can produce dark ground illumination in various ways. First, by use of the bull's-eye condenser, whereby a pencil of light is focussed upon the object by a lamp above; secondly, by fastening a circle of black paper upon the plane side of the bull's-eye condenser, and placing it, flat side uppermost, underneath the stage throwing the light from a lamp upwards, by means of the mirror. A third method is that in which a half-inch objective is made to screw into an adapter fitted below the stage—this answers as an achromatic condenser, and, by stopping out the central rays with a small circle of blackened paper, dark ground oblique illumination will be obtained. I have not mentioned the Lieberkuhn's and side reflectors, as *W.* does not seem to require anything special.—*Henry Seward.*

Damar Mounting Medium.—Dr. Carpenter, in his work on "the Microscope," gives the following:—

A.—Gum Damar, half-an-ounce; Oil of Turpentine, one ounce. Dissolve and filter.

B.—Gum Mastic, half-an-ounce; Chloroform, two ounces. Dissolve and filter. Add A to B.

This answers very well, but a much more simple plan is to dissolve

one ounce of Gum Damar in two ounces of Benzol; omitting the Mastic, Chloroform, and Oil of Turpentine.—*Samuel Dent.*

CEMENT FOR GLYCERINE MOUNTS.—In replying to *W.'s* query on this subject I do so because I want to say a few words on the slovenly manner in which many objects are put up in glycerine by certain preparers of objects. The object is soaked in glycerine, put upon the slide and covered with a thin glass cover. The excess of glycerine is then absorbed by a moistened but a squeezed-out brush and a ring of hot and rather thick gelatine solution run round the cover in the turntable. After thoroughly drying, a ring of white zinc varnish, or of asphalt is superposed, the slide being thus finished. This is the process I believe *W.* requires, and I certainly advise him to leave it alone; if he wants to mount objects in glycerine, use a gold size cell, and fix down the cover with gold size. In the course of a year or so, slides mounted in the manner just described, without a cell, are so fragile that on simply wiping the dust off the cover with a soft silk handkerchief the thin glass is in nine cases out of ten removed.—*Thomas Newsome.*

LEAF FUNGI.—I should like to remind the readers of THE NORTHERN MICROSCOPIST that April is the best month for finding the beautiful cluster-cup *Æcidium ranunculacearum* and also *Uromyces ficariæ.* Both are found upon the pile-wort, a plant very common in the Manchester district, Gatley Carr and the surrounding neighbourhood is a capital hunting ground for both. I find them both there, every year.—*Thos. Brittain.*

EMBRYO MUSSELS.—These molluscs form good microscopic objects. If placed in a thin trough or, better, a hollow slide, they may be readily examined with high powers. Amongst a group of them one or other of them will be seen occasionally to shut up spasmodically. The student should not fail to examine them with a polarized light and with a selenite, as their structure is thereby seen much more clearly, and they are well worth mounting as a permanent slide for polarized light.—*Thos. Bolton.*

MOUNTING MARINE ALGÆ.—*Reply to E. C. Jelly.*—Marine algæ, which cannot be mounted in balsam, owing to the collapsing of the fronds, may be washed and afterwards soaked in diluted glycerine (glycerine one ounce, water nine ounces) in a watch glass, which is put into a dessicator so that the excess of water may evaporate. After the tissues have become filled with stronger glycerine, the algæ may be mounted in glycerine jelly in the usual manner.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

H. C.—Your alga is the *Palmella cruenta*, and a nice clean specimen it is. It may be mounted in Deane's medium.

J. T. (Stockport).—There is no doubt but that your fungus is the *Septoria* condition of *Dothidea podagrariæ*, the plant itself is the Gout-weed *Ægopodium podagraria.*

E. H.—We shall be glad to hear from you upon microscopical subjects.

A. de S. G.—Publishers of THE NORTHERN MICROSCOPIST have been instructed to send postal numbers flat.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free.* They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

MYXOTRICHUM CHARTARUM. Well mounted slides of the above, and also *Lycopodium* spores for other well mounted objects.—W. S., 7, Rowland Street, Trafford Road, Salford.

SLIDES. A quantity of Microscopic Slides for sale, or exchange for anything useful.—P. Hague, 170, Freedom Road, Walkley, Sheffield.

TYPICAL SPECIMENS of Lichens, mounted and properly named; in exchange for typical specimens of Mosses, mounted and properly named.—Address:—"Ravenwood," care of Editor, NORTHERN MICROSCOPIST.

SOWERBY'S HISTORY OF THE AQUARIUM for slides of correctly named Mosses.—B. C., care of Editor, NORTHERN MICROSCOPIST.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

MORRIS' ROTATING STAGE. Price 7s. 6d., or exchange for unmounted mosses.—*Alpha*, care of Editor of THE NORTHERN MICROSCOPIST.

FOR SALE, a half-inch objective by Dancer, with collar adjustments, will resolve *P. angulatum.* Price 30s., or will exchange for a good herbarium of correctly named mosses of about 120 species. "D." care of Editor NORTHERN MICROSCOPIST.

TO MICROSCOPISTS.—Educational Series of Plant Structure, 80 varieties, embracing all the most beautiful forms of Plant-hairs, Scales, &c., prepared ready for mounting, 1s. per dozen: postage extra.—W. White, Warden Place, Nottingham.

HASSALL'S FRESHWATER ALGÆ, 2 vols., fine copy, £4 4s.; Sowerby's English Botany, third edition, half morocco, £16 16s.; Seeman's Journal of Botany, first series, rare, and out of print, 9 vols., cloth, £7 7s.; ditto, second series, 9 vols., in half calf, gilt, one vol. in numbers as published, £6 6s.; Phytologist, both series, complete, £5 5s.—Address:—F. J. Warner, Hyde Street, Winchester.

Students of MINERALOGY can obtain specimen crystals of Ruby, Sapphire, Diamond, &c., at extremely moderate prices.—F. Powell, Lapidary, Salterton Place, Egham, Surrey.

THE NORTHERN MICROSCOPIST.

No. 5. *MAY.* 1881.

AN INTRODUCTION TO THE STUDY OF LICHENS.

BY THE REV. W. JOHNSON.

Concluded from p. 90.

THE stratified cellular layers of the Lichen proper are called :—1. *The cortical layer*, (1 & 4 Fig. 13). This is the outer covering of the thallus; and is a somewhat tough, transparent, cellular membrane. In *Peltigera horizontalis*, we found it to be three or four cells deep; these cells in the horizontal thallus, are generally angular from lateral pressure; but in fruticulose forms as in Ramalina, they are tubular and elongate. 2. *The gonidial layer*, (2 Fig. 13). This lies immediately beneath the cortical stratum, and is composed of globular, free, bright green, yellowish, or bluish-green cells. The gonidia in some species, instead of being simple cells filled with green granular matter, are found to consist of clusters of two, three, or more roundish granules, with no distinct cell-membrane. These are termed, *granula gonima*. 3. *The medullary layer*, (3 Fig. 13), This is a mass of cylindrical, interlacing, articulate, colourless cells; which are so woven together, as often to make a milk-white or flesh coloured spongy mass. They enclose the gonidia on the underside of the thallus, and constitute the base of the plant. These three cellular layers are quite distinct from each other. So clearly, that in some of the foliaceous Lichens, they may be recognised by the naked eye; yet, notwithstanding their distinctness, they perfectly cohere and unitedly fulfil the vegetative functions of the plant. Intermediate between all the cells of the thallus, as well as the germinal organs, is a transparent gummy substance called *lichenine*, which binds the whole together, and gives elasticity and comparative toughness to the several parts of the thallus when moist. This gummy matter evidently, has a close connection with the development of the spores; hence, it concentrates and lodges in large quantity in the *hymenium* of the apothecia, which when

fresh, often presents the appearance of a small clot of jelly. The presence of lichenine constitutes a point of difference between the the medulla and paraphyses of Lichens, and the hyphoid parts of fungi. The hypha and paraphyses of the latter, are generally brittle and non-elastic; and they dissolve away in a solution of hydrate of potash. But those of Lichens are thicker, and more flexible, and do not readily dissolve in the said solution like the filaments of fungi. On the ground of this difference, Dr. Nylander says, "No fungus is present in the formation of Lichens. This is demonstrated

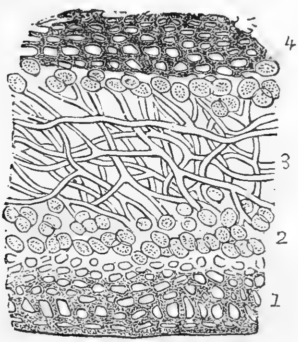


Fig. 13.

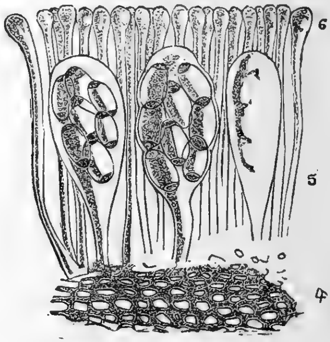


Fig. 14.

from their very first beginnings; for the spores and primary filaments of germination at once show themselves to be of a lichenose nature."* Beside, the three layers of cells already described as constituting the thallus, there is, particularly in crustaceous Lichens, a *hypothallus*. This is the first vegetation of the germinating spore, which underlies the thallus; and, eventually, from the increasing growth above it, becomes a dead mass. It is generally of a black or brown colour, though sometimes it remains white. It will be often seen bordering the thallus, or protruding through it; or, if scattered, filling up the intervening spaces.

The "biological action" of the Lichen-thallus is mostly superficial. It does not increase in thickness beyond a certain point; but it grows upward, or outward from a common centre, according to the form it assumes. The outer portions of the thallus are consequently always the younger. It is not an uncommon thing in foliaceous species, to see the centre of the thallus—the oldest part, entirely decayed and gone, while the periphery still adheres to the rock or tree, and grows on. The centre of vegetative action in the thallus, is undoubtedly in the gonidial cells. They are the

* Vide Grevillea, Vol. VI., p. 44.

chief agents in the growth of the plant. These green cells, says Nylander, "originate in the lower portion of the cortical stratum, and are enclosed in the cells of that stratum, and subsequently, as the development of the same stratum progresses, the gonidia are observed in a free condition."* In their activity, the gonidia frequently burst through the cortex, and appear upon the surface of the thallus in clusters, called *soredia;* or scattered over it like green dust, when the plant is said to be in a *pulverulent* condition.

The colour of Lichens is very varied and changing. This is greatly dependent upon the place of growth, and surrounding influences. There are many shades of colour, but few direct and primary colours,—browns and greys predominate. Green ranges from dark olive to a pale greyish or bluish-green. Yellow, from orange-red and lemon to cream colour and white. Brown changes from pale into chestnut and black; and grey ranges between white and black. These colours are due to the gonidia, and the contents of the cells of the cortex or outer stratum of the thallus.

Having, though but, in a very limited way, touched upon the chief features of the Lichen-thallus, we must now endeavour to convey an idea of its reproductive system. Lichens are said to have many modes of reproduction. Körber enumerates six. Two by spores and four by gonidia. But without accepting that statement, the Lichen undoubtedly has a secondary or indirect method of reproducing itself, by its green cells or *gonidia.* Still, whether the gonidial cell alone can produce a perfect plant, that is a plant which will bear fruit and develope spores, we have not yet seen authenticated. The proper and normal way of fructification in the Lichen, is by *sporidia.* These are developed in a special organ adapted for their formation, protection, maturity, and dispersion, when ripe. This organ is denominated the *apothecium.* (Gr. *apothēkē,* a storehouse or repository.) It is always found upon the surface, or attached to the margin of the thallus. It may be *sessile*—resting upon the surface; *innate*—sunk in the thallus; *stipitate*—on little stalks; or surmounting the top of *podetia.* These latter are cylindrical and vertical prolongations of the thallus, crowned with a cuplike cavity, on the toothed margins of which grow the apothecia, as in Cladonia. In some cases the cup is substituted by globose fruit, singly or conglomerate. The apothecium assumes many different shapes on different plants. It is typically round and flat, or slightly concave—when it is termed *scutellate.* Sometimes it rises up from the margin of the thallus like a target, as in Peltigera; then it is *peltate.* At other times, it is oblong and furrowed; when it is called *lirellate.* It also appears like a

* Vide Grevillea, Vol. VI., p. 44.

little wart upon the thallus, then it is *verrucose.* Besides these, there are other forms. The structure of the apothecium is the most complex part of the plant; and it is beautiful in its arrangement, as well as efficiently adapted for its purpose of maturing and protecting the spores. The apothecium consists of two parts: an *excipulum* and a nucleus, called the *hymenium.* The *excipulum* is the outer covering, or envelope of the apothecium. It is seen encircling, or more or less enclosing the fruit. When it is of the same texture and colour as the thallus, it is termed a *thalline excipulum.* But when it differs from the thallus, and partakes more of the colour of the nucleus, it is a *proper excipulum.* The *hymenium*, or *thalamium*, is the centre of the fruit organ, and is easily recognised by its colour and gelatinous appearance. It embraces the paraphyses, asci and spores. The *paraphyses* (6 Fig. 14) are long, slender, cylindrical, hyaline cells, or filaments; swollen at the apices into the shape of a club, where they are also frequently of a dark or pale colour. They grow upright or vertical from a bed of cells, known as the *hypothecium*, (4 Fig. 14), and stand like corn in a field, only closer together. Their apices are glued into a solid mass, and form what is called the *epithecium*, or disc of the fruit. The direct function of the paraphyses is not clearly understood; but it is, without doubt, to subserve the spores. By their agglomeration, they retain around the asci, if they do not secrete it, a large quantity of lichenine, which helps the nourishment of the young sporidia. They also hold up the asci in a vertical position, when being full of spores, they would otherwise fall down upon the hypothecium; and when the asci and spores are ripe they act as a sort of spring upon them, caused by the expansion and contraction of damp and dry weather. The spores are thus, by pressure expelled into the air, through the disc or epithecium; when the wind wafts them on, to grow in new spheres. The *asci* or *thecæ*, (5 Fig. 14), are large vesicles or sacs, growing upright among the paraphyses from the hypothecium. They are in shape oblong, pyriform, linear or clavate; but always tapering off at the base. They are closely pressed by the paraphyses, from which they differ by being broader and inferior in length. The spores are formed and matured in these sacs; and when ripe, by the lateral pressure of the paraphyses, or the internal pressure of the spores, or from both, the ascus ruptures at the apex, and the spores are liberated. The *spore* (Gr. *spora*, a seed), Fig. 14, is the reproductive germ. It is formed in the ascus from a protoplasmic-lichenine matter. When mature, it consists of a cell having an inner and outer wall, termed respectively, the *endosporium* and *episporium.* It is frequently divided by septa into two or more cells. The spores are generally eight in number, in each ascus; but some of the larger spored forms, as Pertusaria, produce in the spore-sac four, two, and some-

times only one spore, while on the other hand, in minute spored species, they are innumerable. The form and colour of the spores are very much diversified. They range from globose to fusiform and acicular. That is, from round to spindle and needle shape. Their colour is from a pale greenish or yellowish tinge, to a dark olive or deep brown.

Composed of these several parts, the apothecium constitutes the female organ of the fructification, the spores of which are fecundated by the minute bodies next to be described; but how, or in

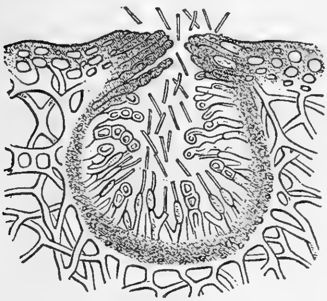


Fig. 15.

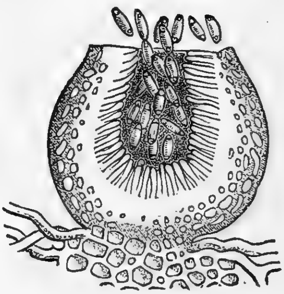


Fig. 16.

what way, this fecundation is affected, has not yet been discovered. The fecundating bodies are termed *spermatia*. They are very minute rod-like, or oval organs, varying in length and breadth; and are sometimes bent or curved; they are uncoloured and transparent. These organs are produced in small cavities, sunk or immersed in the Lichen-thallus; and opening on its surface by a small pore. These cavities or cysts are called *spermogones*. (Fig. 15). They sometimes require a lens to discover them; but, on some thalloidal forms, they are plain and prominent. As, for instance, the laciniæ of certain Ramalinas, and the fronds of *Ricasolia amplissima*. The interior of the spermogonic cell is composed of a number of delicate, elongated filaments, all growing from the walls of the vesicle, and at once projecting and converging into the centre of it. These filaments are denominated *sterigmata* (Gr. *sterigma*, a prop or support) from the fact that they bear the spermatia. The sterigmata are sometimes simple or articulate and branched, and they bear the spermatia on their sides or apices. The contents of the spermogones like those of the apothecia, are truly lichenose, being filled and bathed with lichenine. Perhaps, we should mention another minute organ found upon the Lichen, and named *pycnidēs*. These externally resemble spermogones, and only a microscopical examination can distinguish them. They differ, however, in their internal growth. Instead of sterigmatic filaments,

they contain simple, short, thickish stalks, or stoutish cells, called *basidia*, which generate and bear on their apices *stylospores*. These are pyriform or oval bodies, something like ordinary spores. The function of pycnides like that of spermogones, is still very much shrouded in mystery, and until this is understood, we cannot truly know the real difference between them. They are illustrated by Fig. 16.

We have already hinted that the Lichen has no axis and no root. Therefore it does not nourish itself from the soil, or place of growth. It is an aërial plant, and what the water with its solutions is to the Alga, so the damp atmosphere is to the Lichen. The whole plant imbibes nourishment alike, and its growth is, therefore, much affected by the purity, dryness, or humidity of the air. A polluted atmosphere is destructive to Lichen growth, while a flourishing condition of these plants, is a sure indication of the purity of the surrounding aërial medium. On account of their spongy, cellular nature, Lichens are strongly hygrometric. After being in the herbarium for years, on the application of moisture which they greedily absorb, they will freshen up and appear almost as bright and green as when first gathered. While humidity promotes their growth yet they are capable of enduring great drought. The crustaceous Lichens are of very slow, and frequently very long growth. Some are said to grow for hundreds of years. They cover, and emboss in grey and gold, the rocks on our highest mountains; to which they cling so closely, that no storm affects them. The foliaceous plants, contrary to the crust-forms, attain their highest development at low attitudes, and in shaded places. Some of the softer and less thalline plants grow to maturity in a short space of time. I gathered myself, *Odontotrema longius (Nyl.)*, in considerable quantity on an old rail, near Asby, Cumberland, in the autumn of 1879. In the same month of last year (1880), I visited the same spot, and upon the old cuttings of the previous year, upon the very knife marks, I found the same plant regrown. No thallus was visible, but some of the apothecia, when examined under the microscope, were fully developed. This growth of the Lichen had been made in one year.

The *habitats* of Lichens are almost all objects on the surface of the earth. They grow abundantly on rocks, old walls, rails, the bark of trees, the ground, old stumps, exposed tree roots, the withered fronds of ferns, on mosses, sheep's dung, mortar, and some have been found on glass. They are natives of the whole country side.

> "With such a liberal hand has Nature flung
> Their seeds abroad, blown them about in winds."

Although our remarks partake more of the character of hints

than full statements, yet, on account of their length already, we must at present omit noticing the *uses* and *applications* of Lichens, with their classification and *geographical distribution;* and we must proceed to give a few suggestions on the method of studying this group of plants. Now, the thing of primary importance in the study of any subject, is a definite object. To fritter away our time over a score of different things, answers no purpose beyond a momentary gratification in our own mind. It leaves no permanent results, nor deep sense of satisfaction. We must select where the subjects before us are so many. Our selection should be made with due regard to the tastes and idiosyncrasies of our own minds, and the favourableness of our circumstances for the pursuit. With definite aim and concentration of powers, we are sure to work to some good end. Further, it is not desired that any student of Nature should content himself with being merely a collector, classifier, or herbarium-maker; but that he should seek a more intimate acquaintance with things. Knowledge is only sound and good in proportion as it is profound; for it is only when we know the nature of things, that we can assign them their proper place in systems, or increase their useful application in daily life. In the study of Lichens, the first thing needed is a text book, or some source where we can obtain a sufficient knowledge of the plants, as to become a starting point for our own observations. The meagre notice taken of Lichens in most Manuals on Botany, is of little or no use. Hitherto, it has hardly seemed to come within the aim of books of that class, to acquaint any one with our Cryptogamia; and Lichens, more than any other group of plants, have been ignored or neglected by them. The best book, and the only suitable one we have at present for a beginner in Lichenology, is "A Popular History of British Lichens," by Dr. W. L. Lindsay. This book is simply and well written, also beautifully illustrated. It costs about seven shillings. After that, "A Manual of British Lichens," by W. Mudd, is a good work, but it is scarce. The chief book on the subject is "The Lichen-Flora of Great Britain, &c.," by Rev. W. A. Leighton, 3rd Ed., 1879. Price 21s. This last work can only be used after some acquaintance with the subject. In addition to the literature mentioned, the student will find great help from the possession or access to a series of dried specimens.

After the reading and study of the text book, plants may be gathered. For this purpose you may have to go a considerable distance from home; but begin collecting nearest home first. As you acquaint yourself with the plants nearest your own immediate neighbourhood, then widen your area of search. Select a fine day for collecting. A little damp in the air will be an advantage; because some gelatinous and foliaceous Lichens growing on stones, if very dry, are apt to break and crumble in gathering. When in

that condition, we have sometimes sprinkled them with water from an adjoining stream; and in a minute or two, they have yielded beautifully to the broadish point of the knife beneath them. Specimens should always be gathered, if possible, in fruit; and as near complete as can be. Preparations should be made for this out-door work. Put on clothes which will neither trouble nor deter you from thrusting yourself into any corner. Let your boots be such as will cross swampy ground, or dip into a stream without discomfort. You will also require a pocket lens; a strong, sharp knife; a hammer, and two or three mason's chisels. If you carry only one chisel, and have to face hard rocks, during the first fifteen minutes you may find yourself half helpless for the rest of the day, by the turning or breaking of your chisel point. Crustaceous Lichens are gathered by cutting away a piece of the stone on which they grow, and the other forms accordingly. You will further need a botanical box, or small basket, and many of the specimens will require wrapping in paper, to prevent rubbing, in carrying them home. Take particular note where the plants are gathered, so that the locality in a word or two can be written upon the sheets when they are mounted.

On reaching home with your gatherings, the first thing to be done is to press and dry the foliaceous and fruticulose forms. Then mount the whole on slips of paper, with gum or glue. We find nothing to answer this purpose better than a thick solution of gum Arabic, with a few drops of glycerine in it, to modify its brittleness. On each slip of paper record the place where gathered, with date, and collector's name. The plants may now be placed together on one side, without danger of confusion, and be brought out one by one for determination or study as you may have leisure and opportunity. In the investigation of Lichen tissues and sporidia, and the determination of species, there will be required a compound microscope, with a magnifying power of from 60 to 400 linear measurement (one-inch and quarter-inch objectives with A and C eye-pieces); also, a double lens for the eye. Some use an ordinary watchmaker's eye-glass. One of these glasses mounted in a pair of spectacle frames, would be very useful for the lichenologist. A small thin dissecting knife, and solutions of iodine, hydrate of potash, and hypochlorite of lime. The making up, with the application of these re-agents, are fully described in Leighton's Lichen-Flora. The iodine acts more or less upon the *gelatina-hymenea* of the paraphyses and asci, turning them blue, yellow, or vinous-red. The hydrate of potash dissolves the gelatina-hymenea, and shows the hymenium more clearly under the microscope, beside swelling the spores and paraphyses up to their full size. The hydrate of potash and hypochlorite of lime are also used on the Lichen-thallus as tests; and, as such, are of consider-

able value and importance. On account of the chemical elements in the thallus, it re-acts in certain colours, or not, on the application of these re-agents. This reaction, or non-reaction, is a great help in the determination of species. The method of examining the apothecium or other organ of the Lichen, is to place the plant on the table, then, with the lens to the eye, place the knife on the top of the organ about midway, and cut it straight down. Cut down a second time close to the first, and thus get out a section as thin as you possibly can; place it in the compressor, or upon the glass stage of the microscope, moisten it with clean water, and put on a thin glass cover. Now you may examine the section, and if you have a good cut, you will have all the parts of the apothecium before you. You must now observe the colour and form of the hypothecium, the character of the paraphyses, with the colour of their apices; also, the shape of the asci, and the number, colour, form, and septa of the spores. You may now run in a drop of iodine, watch and carefully note the results. After this, run in a drop of the hydrate solution, which will annul the action of the iodine—consequently it must always be used after it, where both are required. This does not generally destroy any natural colour, but it will show you, if you have obtained a correct idea of the several points just named above. When you have thus examined the apothecium, and the spermogones if you can find any; and have likewise observed the nature of the gonidial layer, then carefully group the outer features of the plant. As well as a mark of carefulness, it is a good disciplinary process to write down all the points in examination as you go on, both internally and externally; and, when this is complete, turn up the Manual and look for a description of your plant, under that family, series, tribe, or sub-tribe, to which you have already concluded it belongs. Drawings of the spores, or any part of the plants, should be attached to the sheets upon which they are mounted, and the whole be arranged together in the herbarium, according to their classification. Microscopic slides, neatly mounted and finished, illustrating different plants, are very useful for reference and instruction.

The Lichen-herbarium is usually made up according to the taste and convenience of the parties concerned. Leighton describes his in his Lichen-Flora. If it is intended that the herbarium shall follow the order of the system of classification, then the best way is, to mount each species and form, upon a separate sheet of cartridge paper, cut to a convenient size, and in due order arrange so many together, in suitable covers, upon the herbarium shelves. Thus, as fresh or new species come, they can be inserted in their proper places.

The Lichen-Flora of Great Britain, at present, comprises upwards of 1700 species, forms, and varieties; and, undoubtedly,

there are yet many new species to discover. Here then, is a wide field for activity and enterprise; and we can promise that it is as full of delight and interest as it is wide. But, the morphology, chemical nature, and the relation of Lichens to the atmospheric medium, are yet to investigate. Researches in these departments have been begun, but that is all. These deeper subjects of study though, can only present themselves properly to the mind of the student, when he has mastered the primary elements, and learned readily to distinguish one plant from another.

LANTERN TRANSPARENCIES OF MICROSCOPIC OBJECTS.

IN the preparation of transparencies for the lantern it is necessary first of all to secure a good sharp negative; this is placed above another gelatine plate (preferably Wratten & Wainwright's ordinary—not instantaneous) and exposed for a moment to the light; the latent image is then to be developed and fixed in the usual manner, after which it may be toned with platinum to improve the color of the deposit.

Transparencies for the lantern may also be prepared by means of the autotype process upon carbon tissue. They have to be manipulated with much care, and the operator should follow the instructions which have been laid down by the Autotype Co. in their shilling manual. Thus:—

"In order to secure the necessary vigour and clearness to produce a brilliant picture when thrown upon the screen, a paper is required having a quantity of very fine opaque pigment—this is provided by the Company's special transparency tissue, which is made with Indian Ink dissolved and filtered with extreme care.

It is sensitized by floating upon a solution of neutral or normal bichromate of potash and dried in the dark.

The negative should be masked by means of black paper, with an aperture of the desired shape, to include as much of the picture as may be wished for.

The picture should be printed strongly, and will require considerably more exposure than if to be developed for transfer to paper: the glasses being cut the proper size for the lantern holder, should be carefully cleaned and coated with a solution made as follows: Gelatine one ounce, water nineteen ounces, chrome alum twenty grains; with this, coat the plate by pouring on as if collodion, and allow to run off at one corner. The glasses may be prepared any time before-hand, and when dry are fit for use.

When the latent picture is taken from the pressure frame, turn

up the edges to form a sort of dish, coat its face with thin collodion, and allow to dry.

Immerse the plate and the coated tissue in cold water, when the latter has become limp, place it on the glass under water, avoiding air bubbles, and force into contact with the squeegee, allow it to remain for a few minutes, then put into warm water, strip and develope as previously described—immerse in alum solution and wash well with cold water.

When dry, the picture should be covered with another piece of clear glass the same size, the two being prevented from touching by very small strips of card fastened by gum to two of the edges, the whole bound round with thin black paper and the slide is completed. These pictures when laid upon white paper should only allow the paper to show through in the very highest lights, just a patch of white here and there.

Should the picture not be sufficiently vigorous, it can be easily made as intense as may be desired, by pouring over it, before it is allowed to dry, a three-grain solution of pyrogallic acid, to which a few drops of nitrate of silver solution are added in the same way that a negative is intensified."

PROPOSED MICROSCOPICAL SOCIETY FOR CARLISLE.

A MEETING of gentlemen in the study of microscopy was held on Wednesday night, April 13th, in the County Hall, for the purpose of taking into consideration the question of forming a Microscopical Society for Carlisle. Mr. Robert Ferguson, M.P., and, subsequently Mr. Hepworth, (Mr. Ferguson having to leave) Carlisle, presided; and among others present were Mr. Hall, surgeon; Dr. Maclaren, Dr. Carlyle, Dr. Barnes, Dr. Macdougall, Dr. Campbell, Dr. Russell. Mr. W. Brown, surgeon; Mr. R. J. Baillie, Mr. Bissell, Mr. Hallaway, Mr. Slingsby, Mr. Fisher, Mr. Tom Duckworth, Mr. W. Duckworth, Mr. Sinclair, Mr. Hill, Mr. Hands, Mr. Dodd, Mr. James Young, Mr. Halton, and the Rev. Charles Dowding, curate of Dearham. Mr. Hall brought the subject before the meeting in a few prefatory remarks. He said an attempt had been made on a previous occasion to form a Microscopical Society in Carlisle, but he believed it was a failure. Nothing daunted by that failure he determined to take steps with a view to the formation of another Society. He had written to several gentlemen to ascertain their feeling about it, amongst others to Colonel Salkeld, who expressed a willingness to become a member of a Society, if formed; and to the Rev. Canon Carr, Dalston,

who answered that he would be glad to do everything in his power to further the interests of the Society. Speaking of the advantage that might be derived from such a Society, it might be stated briefly that members might meet together to compare different instruments, talk over subjects of study, provide suitable books, periodicals, and other things of microscopical interest. He might say that it had been suggested that this Society should be affiliated with the Field Naturalists' Society of Carlisle. He had very carefully considered this matter and had advised with gentlemen who had promised to become members, most of whom happened to be absent to-night. He was of opinion that though this Society should certainly work hand-in-hand with the Field Naturalists' Society, and do all it possibly could to promote the interests and well-being of that Society; yet, at the same time, it was absolutely necessary that this Society should have control of its own finances, and the management of its business as well as the election of its own office-bearers. A larger sum of money was required to keep a Microscopical Society satisfactorily going than to support a Field Naturalists' Society; and after inquiring in various directions, as well as from his own experience of Microscopical Societies, he was distinctly of opinion that a 10s. yearly subscription for each member was the smallest sum that could be contributed to carry on successfully a small Microscopical Society. He moved a resolution that it was desirable to form a Microscopical Society in Carlisle, to be called the CARLISLE MICROSCOPICAL SOCIETY, with an annual subscription of 10s. payable in advance. The meeting seemed to have made up their minds as to the desirableness of forming a Society in Carlisle, but the questions whether the subscriptions should be 10s., and whether the Society should be altogether distinct from or affiliated with the Carlisle Scientific Society, as a section of that Society, gave rise to a fair amount of discussion. Mr. Hall took the view which we have already stated; others held the opinion that it would be the more practicable plan to have the Microscopical Society affiliated with the Scientific Society as a section of it, with a subscription of perhaps 5s. from the members of that Society, and leaving the management of the funds and business of the Microscopical Society in the hands of the members of the section. The advantages of such a course, it was thought, would be the use of the Museum for meetings, and an increased membership. Ultimately it was agreed that it was desirable to form a Microscopical Society in Carlisle. Dr. Barnes then moved that steps be taken to ask the Committee of the Carlisle Scientific Society to make arrangements to form a Microscopical Section of their Society, with a special management. Dr. Campbell seconded the proposal. Mr. Hall moved an amendment that it be a separate Society as regards the management of its funds and of its own

affairs. He had no objection to its being called an affiliated Society of the Field Naturalists' Society, with which he had strong sympathy. Dr. Russell proposed that the consideration of the subject be postponed till another meeting, and in the interval the opinion of the Scientific Society could be taken as to the question of affiliation as proposed. This proposition met with general approval, and a provisional committee, consisting of Mr. Ferguson, M.P., Mr. W. I. R. Crowder, Dr. Barnes, Mr. Sinclair, Mr. Hepworth, Mr. Hall, and Mr. W. Duckworth was appointed to attend the annual meeting of the Scientific Society, on the 3rd of May, and report to an adjourned meeting on the following evening. Votes of thanks to Mr. Hall and the chairman terminated the proceedings.

PHOTOGRAPHING BACTERIA.

By Dr. Koch.

(Extracted from the *Photographic News*, Oct. 22nd, 1880.)

THE following method for producing photographs of the bacteria may be of interest to some of our readers, who will see that it differs in no respect from that of Dr. Woodward, and published many years ago in the Monthly Microscopical Journal:—

"The photo-micrographs that I forwarded to Professor Lister represent, for the most part, images magnified seven hundred times. I employed, for the purpose of securing them, an immersion lens by Siebert and Kraft, opticians of Wetzlar; and I may say that the instruments of these makers are particularly well adapted to micro-photographic work. Lens No. vii. was the instrument chosen by myself, and for my own part I prefer the system to that of Hartnaeker; I prefer it even to the oil immersion system of Zeiss, when the latter is not provided with a correction lens, or Woodward's so-called amplifier.

"The tube of the microscope—or, rather, the tube in connection with the microscope—was capable of drawing out to a length of two metres (six feet). The microscope and tube were horizontal, and, in place of the eye-piece, a small bellows camera was attached, care being taken, of course, to exclude light at the junction of tube and camera. I employed the wet collodion process, practising it in the ordinary manner.

"I managed the lighting of the object to be photographed in the manner following. The object was a thin microscopic preparation, and so that sufficient illumination should be concentrated upon it, I employed sunlight, reflected by means of a heliostat. A wide-angle condenser was, moreover, employed to concentrate this

powerful light. At the same time, I did not use bare sunlight, which, as is well known, gives not only hard pictures, but pictures rendered defective by interference phenomena. I allowed the sunlight to pass through an ammoniacal solution of copper rendered as monochromatic as possible, and then diffused and softened it by allowing it to pass through ground glass. To this I attribute, in the main, the sharpness and purity of my pictures. Using diffused sunlight through ground glass in this way, I find that an exposure of about two minutes suffices in the case of an enlargement of seven hundred times.

"Of course, with gelatine, I shall be able to make shorter exposures, and I am just now engaged in making test experiments relating to its sensitiveness. I am also testing gelatino-bromide in respect to its sensitiveness in particular for violet and blue light, as also for green and yellow, my object being to see how far I can photograph preparations stained blue; for in pathology and histology the microscopic preparations are, for the most part, of this tint. The question of colour enters also largely into the matter when bacteria are to be reproduced; but I have little doubt that the gelatino-bromide process will lighten the labour of the micro-photographer very considerably."

NORTHERN SOCIETIES.

BOLTON MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER NATURAL SCIENCE ASSOCIATION. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER MICROSCOPICAL SOCIETY. Hon: Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER CRYPTOGAMIC SOCIETY meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER SCIENCE ASSOCIATION. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. NORTH OF ENGLAND MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. No Microscopical Society in existence.

NOTICES OF MEETINGS.

MICROSCOPICAL SOCIETY OF LIVERPOOL.—The fourth ordinary meeting of the Thirteenth Session of this Society was held at the Royal Institution, on Friday, April 1st, 1881; Dr. Carter, President, in the chair.

The Hon. Sec. announced the donation of twelve microscopic slides from A. C. Cole, Esq., London, honorary member; and the Journal of the Quekett Club, from the club. One new member was elected, and two gentlemen were nominated for election.

The President then called upon Mr. Mayall, Junr., F.R.M.S., for his communication on "Brass and Glass."

Mr. Mayall said it might be in the recollection of many then present that about a year ago he had the honour of addressing a few remarks to the society on the subject of immersion objectives, with particular reference to the increase of aperture which the immersion system developed over the maximum apertures of dry objectives. The remarks he had then made appeared to have produced an impression on the Hon. Secretary of the society, and at the conclusion of the meeting that Hon Sec., with a zeal peculiar to the energetic race of honorary secretaries, pressed him to promise a more detailed exposition of his views on aperture and matters relating thereto. In fulfilment of the promise then extracted from him, Mr. Mayall said he had come to Liverpool, not however with a formal paper on the subject, but with the intention of giving a few illustrations in popular form, which might fittingly be given under the heading of "Brass and Glass." By "Brass and Glass" must be understood that part of microscopy concerned with the development of the microscope as an instrument apart from its applications to this or that special branch of study. Mr. Mayall said that it had recently been most ungenerously stated in public that the "Brass and Glass" party among the microscopists cared for nothing but mere display of elaborate apparatus, that they vied with each other in encouraging the manufacture of more and more expensive instruments for the gratification of their personal whims and fancies, and without the slightest reference to advancing any scientific branch of microscopy. It was no part of his programme to explain in detail what really was expected to be gained by encouraging opticians to construct stands, objectives, condensers, all which from their elaboration must necessarily be costly; but might point generally to the fact that the most conspicuous developments in recent microscopy—particularly the delineation of microscopic objects by means of micro-photography—were absolutely dependant on the perfection of the instrument. Now the improvement of the instrument itself was by no means so petty a subject as it had been sought to insinuate. He (Mr. Mayall) thought that a thorough investigation of the principles upon which the improvement of the instrument depended, was by no means an unworthy or idle task; and he thought that if those principles were more generally appreciated, much more rapid strides would be made, and certainly there would be far less publicity given to crude and erroneous interpretation. The ground would in fact he cleared of much mere controversial verbiage. Taking, as an example, the prevalence of erroneous views with regard to the meaning and function of aperture—he would endeavour to give to the meeting a clear statement of the old theory of this matter, and meet it point for point as the newer views of which Professor Abbe, of the University of Jena, was the originator. Then by means of a large number of diagrams which he drew on the blackboard illustrating his subject, Mr. Mayall dealt at considerable length on the main features of what he termed the "Aperture Controversy," concluding his remarks in that branch by an earnest appeal to all present if they had any difficulties to suggest to suggest them forthwith—as it was the ardent desire of himself and those with whom he was associated in the controversy to have every point of difference thoroughly explained, their sole motive being the promulgation of accurate views. Mr. Mayall also exhibited and described in

detail several specimens of "Brass and Glass," some of which he commended to the notice of the meeting, whilst of others he remarked, "the less said, the better." Amongst the former were Tolles's microscope, with vertical disc for the lateral rotation of the sub-stage with two stages, of novel construction; Ross's new mechanical stage; Crouch's student's microscope, with approximately frictionless, fine adjustment; Parkes' child's portable microscope, &c. &c.

At its conclusion a cordial vote of thanks was accorded to Mr. Mayall, and the meeting terminated with the usual conversazione.

MANCHESTER CRYPTOGAMIC SOCIETY.—Monthly meeting, March 21st, Dr. Carrington, F.R.S.E., in the chair. The principal part of the evening was devoted to the subject of Ferns, Mr. Foster having brought a very large series of dried ferns, beautifully mounted. The greater number were abnormal forms of British species, and the extreme variations were a source of interest to those who took a delight in this class of cryptogams. A collection of the ferns of Madeira, which had lately been presented to the Free Reference Library by the executors of the late John Windsor, F.L.S., was partially examined by those present.

The hon. secretary (Mr. T. Rogers) called the attention of the members to a series of microscopic slides which he had brought, showing the prothalli of ferns in various stages of development; some showing the sperm cells, and others the perfected young plants.

Two slides showed the germination of the spores of Hymenophyllum while still in situ in their bi-labial indusium on the frond.

Other slides showed the germination of young ferns direct from the spore receptacles on the veinlets of the pennules *Adiantum Capillus-veneris.* In some cases these could be seen under the perfected indusium, whilst in others the indusium was imperfect and rudimentary.

Mr. W. H. Pearson exhibited specimens and drawings of a hepatic new to Britain, *Jungermannia Juratzkana* (Limpricht), which he had detected in a collection made by Mr. West, of Bradford, when on Ben Lawers last August.

Mr. Pearson also read a translation of a paper by G. Limpricht on *Gymnomitrium adustum*, in which he clearly establishes the fact of a true *Gymnomitrium adustum* (Neas). He therefore now alters the name of *Sarcoscyphus adustus* (Spruce) to *Sarcoscyphus Sprucei* (Limpricht). Specimens and drawings of the two species were afterwards shown.

Mr. Pearson exhibited specimens of new *Radula commutata* (Gottsche) which had been collected by C. J. Wild, in the same locality as previously mentioned at the last meeting.

Mr. Champs, Mr. Dawson, and Mr. Stanley were elected members of the Society.

MANCHESTER MICROSCOPICAL SOCIETY.—The following list of objects exhibited at the Annual Soirèe was crowded out of our last issue; we have much pleasure in introducing it here, as it may serve other Societies as a guide what to exhibit on similar occasions:—

Hydra vulgaris	Mr. J. L. Miles.
,, ,,	Mr. Furnival.
Vorticellæ	Mr. H. J. Jenkins.
Larvæ of Gnat	,, ,,
Vorticellæ	Mr. J. Dutton.
Lophopus crystallinus	,, ,,
,, ,,	Mr. R. Graham.
Carchesium polypinum	,, ,,
Sea Water Aquarium, containing :—*a.* Plumose Anemone; *b.* Daisy Anemone; *c.* Sand Mussel	Mr. R. Graham.
Flower Groups, formed of Butterfly Scales	,, ,,

Foraminifera...Mr. E. Ward.
Plumed Antennæ of Male Gnat .... ,, ,,
Polycistina from Barbadoes................................... ,, ,,
Cross, formed of Insect Scales................................ ,, ,,
Stained Vegetable Sections.................................... ,, ,,
Head of Female Gnat.. ,, ,,
Group of Flowers, formed from Scales..................... ,, ,,
Micro-Photograph... ,, ,,
Case of Objects exhibiting various branches
of Natural History. Mr. E. Ward.
Book Scorpion...Mr. Blackburn.
Cast Skin of Larva of Day Fly............................. ,, ,,
Eggs and Eyes of Insects...................................... ,, ,,
Grouped Polycistina.. ,, ,,
Spicules of Glass Rope Sponge.............................. ,, ,,
Human Parasites... ,, ,,
Parasite of Beetle... ,, ,,
Trichina spiralis in Pork .... ,, ,,
,, ,, Rat's Tongue......................... ,, ,,
Diamond Engraving on Glass, Letters....................
1-500 inch in height.. ,, ,,
Larvæ of Gnat...Mr. Ald. Duncan.
Daphnia pulex .... ,, ,,
Winter Gnat... ,, ,,
Polycistina... ,, ,,
Leg and foot of Water Beetle ....Mr. J. H. Barton.
Cheese Mites.. ,, ,,
Foraminifera from Brazil.............................Mr. H. Greenhalgh.
Head of Gnat...
Gizzard of Cricket..
Section of Injected Kidney (Homo)...........................Dr. Haslam.
,, ,, Intestines (Homo)........................ ,, ,,
,, ,, Liver (Homo)............................. ,, ,,
Section of Cartilage... ,, ,,
Stomach of Cockroach.. ,, ,,
Stratified Epithelium from Stomach of Horse............... ,, ,,
Foraminifera from Loch Foyle............................Mr. T. D. Haigh.
Raphides of Cactus.. ,, ,,
Sections of Cane and Mountain Ash.....................Mr. Richardson.
Zoophytes and Scales from Skin of Sole............... ,, ,,
Head of Black Beetle... ,, ,,
Section of Human Skin (Stained)........................Mr. Alex. Hay.
Spiracles of *Dytiscus marginalis*............................ ,, ,,
Brittle Star..Mr. F. J. Randle.
Crystals of Tartarate of Soda.............................. ,, ,,
Sections of Granite and Fossil Limestone............. ,, ,,
Stellate Hairs of *Deutzia gracilis* .... ,, ,,
Section of Stem of Water Lily............................. ,, ,,
Polycistina and Spine of Echinus............................Mr. J. Smith.
Tongue, Foot, and Spiracles of Blow Fly .... ,, ,,
Spiracles of *Dytiscus marginalis* .... ,, ,,
Antennæ of Cockchafer .... ,, ,,
Transverse Section of Stem of Clematis.................. ,, ,,
Section of Potatoe, with Starch Granules............Mr. J. T. Smith.
Transverse Section Rhinoceros Horn...................... ,, ,,
Young Oysters and Scale of Perch......................... ,, ,,
Spores of Equisetum...Mr. J. C. Hope.

Wood Gnat ....M. J. C. Hope.
Sections of Coffee, Chicory, and Coffee..................Mr. P. Yates.
Proboscis of Blow Fly...
Equisetum (Cuticle of)...
Flea, Male..Mr. Parsons Shaw.
Diatoms...Mr. Alston.
Micro-Photograph of Speeches from Shakespere......Mr. A. Ogden.
Proboscis of Blow Fly.................................... ,, ,,
Winter Gnat.. ,, ,,
Foot of Blow Fly.. ,, ,,
Paper Mildew...Mr. Stanley.
Cuticle of Pelargonium, shewing Stomata................. ,, ,,
Spores of *Gleichenia flabellata*............................Mr. R. Sowood.
Section of Eye of Insect............................Mr. H. P. Aylward.
Mouth of Cockroach.................................... ,, ,,
Sting of Wasp.. ,, ,,
Head and Tongue of Flea.................................Mr. F. Truefitt.
Arranged Scales.. ,, ,,
Strychnine Chloride.....................................Mr. Albert Norris.
Santonin... ,, ,,
Potassium Nitrate.. ,, ,,
Zeolite.. ,, ,,
Vallisneria spiralis (Rotation in) ....Mr. Greenwood.
Vertical Section of Human Scalp........................Mr. J. C. Brown.
,, ,, Cat's Tongue....................... ,, ,,
Head of Male and Female Gnat....................... ,, ,,
Spiracles of *Dytiscus Marginalis*....................... ,, ,,
Stamen and Pollen of Mallow .... ,, ,,
Proboscis of Blow Fly.................................... ,, ,,
Section of the Stem of Water Lily .... } Mr. E. B. Cook.
Section of Spine of Echinus.......................... }
Elytron of Diamond Beetle........................... }
Longitudinal Section of Jaw of Mouse Injected.. }
Benzoic Acid...Mr. N. Waring.
Stellate Hairs on *Deutzia scabra* ....
Hairs on Leaf of *Deutzia gracilis* ....Mr. J. Robinson.
Eggs of Magpie Moth..................................... ,, ,,
Parasite of Wild Bee.....................................Mr. J. Dunkerley.
Proboscis of Fly... ,, ,,
Silky Earth Mite.. ,, ,,
Parasite of House Fly..................................... ,, ,,
Trichina spiralis (Human Body)..................... ,, ,,
,, ,, found in Pork.....................Mr. E. W. Napper.
Striated Muscular Fibre................................ ,, ,,
Section of Cat's Tongue........... .... ,, ,,
Polycistina from Barbadoes............................Mr. Parsons Shaw.
Sheep Tick.............. ....Mr. H. Champ.
Foraminifera from Dredgings, off Shetland.............. ,, ,,
Arranged Diatoms.. ,, ,,
Cuticle of Elæagnus...Mr. N. Waring
Transverse Section of *Rubus fruticosus* single stained, Mr. J. Doherty.
,, ,, *Rosa canina* (double stained) ... ,, ,,
,, ,, *Piper nigrum* .... ,, ,,
Foraminifera and Diatoms......................................Mr. Chaffers,
Photograph of Dr. Bradley seen through Eye of Dytiscus, Mr. Furnivel.
Stamens and Petals of Wilds Flowers
collected at Lytham in 1880. ....Mr. F. W. Lean.

Sand from Southport	Mr. J. L. Miles.
Decoloured Leaf *Deutzia gracilis*	,, ,,
Cheese Mites (alive)	Mr. H. Hall.
Hooklets in the proleg of Caterpillar	,, ,,
Striated Muscular Fibre of Caterpillar	,, ,,
Nerves of Caterpillar	,, ,,
Saws of Saw Fly	,, ,,
Hairs, Glands, and Scales of Plants	Mr. Lofthouse.
Saws of Saw Fly	Mr. J. Dearden.
Tongue of Blow Fly	,, ,,
Section of Stem of Ivy	,, ,,
,, ,, Fern	,, ,,
,, ,, Oleander	,, ,,
Section of Whisker of Walrus; ,, Marble; ,, Amber — Exhibited by Polarised Light.	Mr. J. Bathe.
Polycistina, with Parabaloid	Mr. C. L. Cook.
Scale from the Skin of Sole	Mr. J. Pettigrew.
Section of Stem of Asplenium	Mr. H. P. Aylward.
Arranged Diatoms	,, ,,
Gizzard of Cricket	,, ,,
,, Cockroach	,, ,,
A New and Simple Mounting Microscope	,, ,,
Four Trays of Objects	,, ,,
Very fine Specimen of *Trichina spiralis* taken from the latissimus dorsi muscle of a subject dissected in the Dissecting Room of the Manchester Medical School	Mr. H. Chadwick.
Series of Slides illustrating the Anatomy and Histology of the Cray fish	Mr. H. Chadwick.
Series of Polyzoa, and Sections of Teeth, Bone, &c., from the Carboniferous Shales of Scotland and Northumberland	Mr. H. Chadwick.
Cornea of Compound Eye of Cockroach	Mr. Parsons Shaw.
Live Flea	The President.
Eggs of Parasite of Partridge	,, ,,
Parasite of a Fish (alive)	,, ,,
Sporangia and Plants from the Lower Coal Measures of Oldham andHalifax	Mr. J. Aitken.

MANCHESTER MICROSCOPICAL SOCIETY.—In connection with this Society, the Bryological Section had its first ramble this season on Saturday, March 12th. On arriving at Crumpsall, the alterations in the aspect of the country by the opening of the new Bury line were soon noticed, and the presence of Tar-color works in the neighbourhood was painfully manifest. Proceeding by the Middleton Road, the common Screw-moss *Tortula muralis*, and the Feather-moss *Hypnum murale* were found, and before leaving Heaton Park wall *Palmella cruenta* was discovered, adhering to the stones like patches of coagulated blood. The Cup-moss Lichen, and a species of *Cladonia* were plentiful, and the Butter Burr *Petasites vulgaris* was also in flower. Search was made for the Red necked forked moss *Dicranum cerviculatum*, but only a few capsules—remains of last year's fruit—were found. *Funaria hygrometrica* was however very plentiful. An interesting species of Jungermannia *Lepidozia reptans* was picked up before leaving Crab Lane. At the kind invitation of the leader, Mr. R. A. Bastow, several of the members adjourned to his home, and spent the rest of the evening in examining and mounting the gathered specimens.

The second ordinary meeting was held in the Lecture Hall of the Mechanics'

Institution, on Thursday evening, April 7th, John Boyd, Esq., President, in the chair.

Mr. Thos. Brittain, Vice-President, exhibited the Lichen *Verrucaria nitida*, and the sporidia of the same in ascus. He also exhibited another interesting Lichen *Graphis elegans* with the fruit in ascus. In referring to the two species, he exhibited drawings of both which he had prepared to illustrate the subject. Mr. Hy. Hall then read his paper on the Anatomy of the Caterpillar. The paper was illustrated by many well mounted slides, which were displayed on a screen by means of the oxy-hydrogen microscope, cleverly manipulated by Mr. John Bathe. This method of illustrating papers on microscopy is worthy of consideration, as the ordinary 3 × 1 slides can thus be well shown to a large audience.

Mr. Blackburn called the attention of the members to a collection of beautifully executed photo-micrographs, which he placed upon the table for inspection. They were photographed by Messrs. Baum and Johnson, of Manchester, who kindly lent them for the occasion. They represented several departments of microscopical study. Amongst them may be particularly mentioned some sections of the eye of the Death's-head moth, showing the ocelli and the branches of the optic nerve on a large scale,—beautiful diatoms, especially Moller's "Typen platte" 400 species on one slide, a symmetrically arranged group of *Triceratia*, and some of the *Pleurosigmata*, one of the latter exhibiting a portion of a valve of *P. formosum* very much enlarged by means of one sixteenth object glass with F eye-piece. The series forms an excellent contribution to the permanent records of microscopy, and a valuable accompaniment to the microscopical Cabinet.

During the conversazione the following objects were shown:—

Hippocampus brevirostris	Mr. Miles.
British Mosses	Mr. Stanley.
Lepidozia reptans	,,
Palmella cruenta	Mr. Sowood.
Verrucaria nitida sporidia in ascus	Mr. T. Brittain.
Sections of Wood double stained	Mr. Doherty.
Sections of Wood infected with Dry-rot, showing the mycelium of the fungus in the cells	Mr. Graham.
Actinophrys Sol	,,
Spiracles and chirping File of common House Cricket,	Mr. H. Chadwick.
Trichina spiralis in Rat's tongue	Mr. Blackburn.
Hair of Bat	Mr. Mestayer.
Rotifer,—*Cycloglena lupus*	Mr. Jenkins.
Phantom larva and Cyclops with Vorticellæ	Mr. Thompstone.

Mr. Alex. Hay, of the Salford Royal Hospital, exhibited a freezing microtome, and practically illustrated its use.

NORTH OF ENGLAND MICROSCOPICAL SOCIETY.—The April meeting of this Society was held in the Patents' Room, Literary and Philosophical Society, on Wednesday evening last, the 13th inst. Dr. Ellis, one of the Vice-Presidents in the chair: there was a good attendance of members and visitors. After previous minutes had been read and confirmed, four new members were elected and other business completed. Mr. John Brown, sen., then read a paper by Mr. H. Pocklington, which had been previously read by that gentleman before the Leeds Chemists' Association, entitled "How to examine plants microscopically." Mr. Brown illustrated this paper with examples of unicellular (yeast) and multicellular plants, treated with reagents and so differentiating vegetable structure. Mr. Brown was thanked by the meeting for his contribution. The chairman (Dr. Ellis) called attention to a remarkable case recorded in the "Lancet" of the 4th inst., where a boy of 16 died after severe suffering, from what would have ordinarily been regarded as Brain disease; a *post mortem*

examination led to the detection of a "measle" (*Cysticercus Solium cellulosæ*) in the boy's brain, identical with the porcine measle dealt with at last meeting, but of extraordinary size—that of a Hazel nut. Dr. Spencer Cobbold reported, that after removing the cyst, the head measured two inches in length. Some remarks were made concerning the very favourable opportunity the so-called Sanitary Committee of the Newcastle Corporation were likely to afford to students of the germ theory of disease—should they, as proposed, bring the Fever Hospital Buildings in close proximity to Bath Lane Schools. The medical gentlemen present regarded this inexplicable action of the Corporation as a very serious matter, and were unreservedly of opinion that such an institution should be isolated as far as practicable. In illustration of the paper read, Messrs. J. Brown, John Arthur, and John Brown, junr., showed vegetable structure treated with reagents. Mr. J. G. Dickinson exhibited a series of preparations under polarised light—shewing gradual development of crystals in cuticle underneath carapace of prawn—apparently the result of the concretionary aggregation of the calcifying deposit, forming the future shell. A vote of thanks was passed to the chairman for presiding.

NOTES AND QUERIES.

Mosses.—Mounted Slides.—I shall be thankful for a few hints on mounting, with names of books and price, or any other information on the same.—*Capax*.

Palmam qui meruit ferat.—In the article on Photo-micrography in our April number, we alluded to several Daguerreotypes taken by Professor Draper, U.S.A., in 1851—1856, as "probably the first attempts at photo-micrography"; but from certain facts and data which have been put before us, we find that in July, 1840, Mr. J. B. Dancer, of Manchester, publicly exhibited during a lecture at the Liverpool Mechanics' Institution, the mode of taking photographs of microscopic objects,—a flea being magnified by the gas microscope to the size of six inches, and a photographic image of it taken on a silver plate during the progress of the lecture. He also took photographs of sections of wood and fossils, both on chloride paper and on plates, by means of the solar microscope. But Mr. Dancer's name is more intimately connected with micro-photographs than with these gigantic productions. In April, 1859, he exhibited before the members of the Manchester Photographic Society a page of printing, from Quekett's "Treatise on the Microscope," reduced to such size that the whole of the volume of 560 pages could be contained in a space one inch long and half-an-inch broad—the page contained 2118 letters. Two pages of Quekett's "Treatise on the Microscope," reduced to one-sixteen hundredth part of a superficial inch; they included 3631 letters, and at the same rate the whole volume could be contained in a space of three-eighths of an inch square. This specimen excited considerable attention, being so exceedingly minute, notwithstanding which,

every letter was perfectly sharp and legible as the original printing, under a high magnifying power. Another specimen contained the written name and address of the Chairman, along with the date, in a small space the size of a hole punctured by a fine needle. Who is there of the present day who has not either seen or heard of Mr. Dancer's micro-photographs?

PHOTO-MICROGRAPHS.—Our article upon this interesting subject seems to be producing fruit. At a recent meeting of the Manchester Microscopical Society, Mr. Blackburn called attention to a collection of very beautifully-executed photo-micrographs by Messrs. Baum and Johnson of this city. They represented several departments of microscopical study. Amongst them may be mentioned sections of the eye of the Death's-head moth, showing the occelli and the branches of the optic nerve on a large scale; also some beautiful diatoms, especially Moller's "Typen-platte" of 400 species on one slide; a symmetrically-arranged group of Triceratia; and *Pleurosigma formosum* with a portion of one of the frustules taken with a $\frac{1}{16}$ immersion objective in combination with an F eyepiece.

Since that date, Mr. Johnson has sent us some of the above, and in addition, *Trichina spiralis in situ*, proboscis of house-fly, *Pulex felis* male and female, *Pulex irritans*, diseased human lung, and the sheep tick *Melophagus ovis*, all of which are admirably taken and form valuable contributions in aid of microscopical study.

We have also heard that the art is being practised in Birmingham, but have no direct knowledge of it.

LEAF FUNGI IN MAY.—When the student of Microscopy has an opportunity of getting a view of the hedge rows and green fields in this, usually, delightful month, he should give a careful look out for leaf fungi, for they now may be found in tolerable plenty. Two of the many which grow upon the common wood anemone, '*Anemone nemorosa*' may be found in great plenty in various parts of the Bollen Valley from Hale to Wilmslow, and also about Marple and elsewhere. The commonest is a black smut, *Puccinia anemone*, which spots the leaf over with interesting regularity: the other is also a black smut, but this is in irregular patches, which burst through the leaf, and is known as *Urocystis pompholygodes.*

Another interesting fungus may now be found upon the Gout weed, *Ægopodium podagraria.* This Dr. Cooke speaks of as rare, and doubtless he is correct, for the plant is rare. Nevertheless, the Gout weed is very plentiful all about Didsbury, Northenden and Gatley. The green lanes leading from Didsbury towards Northenden are full of the plant. The fungus is a black smut which bursts through the cuticle of the leaf in patches: it often is found upon the stalk of the plant.

The season being late, the cluster cup and smut on the Pile-wort

to which I referred in the last number, may still be found almost everywhere, where the plant grows.

Towards the end of the month numerous other cluster cups should begin to make their appearance, but I do not expect to meet with them until June: still if the middle of May should be warm many of these beautiful organisms may be found. One of the best hunting grounds for leaf fungi in May and June is the district between Buxton and Bakewell, especially Miller's Dale and Monsal Dale. The beautiful *Æcidium epilobii* may generally be found in plenty in Miller's Dale about the end of May along the river side, and sometimes on the same plant (the *Epilobium hirsutæ*) may also be found the *Puccinia epilobii.—Thos. Brittain.*

Pond Life.—In reply to "B," I know of no pond in the neighbourhood of Manchester at all approaching the canal at Gorton in richness of yield of objects for the microscope. When at the station there, a few yards on the Fairfield side is a bridge carrying the canal over the railway, and the portion of the canal extending from that bridge southwards to within a short distance of Ryland's mill, is that to which I more especially recommend attention. Thereabouts is the habitation of that splendid Polyzoon—"*Lophopus crystallinus*," which appears to affect the depths or dark nooks from which it is brought to view, attached to shells of molluscs. Two years ago "*Plumatella repens*" was also to be found in great abundance—it then entirely disappeared; and although I have been told it is back again, I have not been able to meet with it. I may state that Vorticellœ and Botifers of all kinds abound, and a list of the organisms generally understood by the microscopist as comprised under the term pond life which are absent, would be much more easily compiled than a catalogue of those present.

In regard to the most convenient form of receptacle in which to carry collecting bottles—waiscoat and other pockets are far from inconvenient; but when specially on the war path, I find a wicker basket nine inches in length, six wide and five high, with handle on lid, a very handy article. It will contain two, four by three inches, wide mouth glass jars (tie-over jars), and sundry smaller bottles; and if pieces of calico are used as packing, they may be found useful at times to receive any weeds which it is intended to treat for diatoms, &c.—*R. G.*

Eggs of Parasites.—It may not be very generally known that the eggs of parasites are very interesting under the microscope. Some "nits," which I have, on the hairs of a *Circopathecus*, show the different stages of development very plainly. The eggs of parasites are easily obtained, from the hairs and feathers of many animals.—*F. Farrow.*

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

G. J. J.—Photo-micrographs received, we have noticed them in another column.

J. B. D.—Your papers came safely to hand; we should have been glad to see some of your enlargements.

J. C. C.—Thanks for your letter. We intend to do exactly what you indicate; but we have been asked by numerous correspondents not to let the journal drift into high "ologies," as our correspondents have been pleased to describe abstruse work only interesting to a few deep thinkers. It is possible we could get your specimens named for you.

G. C. M.—The lichen sections came safely, but they are too thick. It is almost impossible in such objects to make out the structure.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

CHALLENGER DEEP-SEA SOUNDINGS.—Ten well mounted and correctly named, in exchange for other good slides.—Send list to A., 215, Bordesley Green, Birmingham.

MERIDION CIRCULARE.—Mr. W. Swinburne, Yeathouse, Frizington, viâ Carnforth, will gratuitously forward this diatom on receipt of stamped address with sealed quill or tube.

PHOTO-MICROGRAPHS.—A photograph, much enlarged, in exchange for a well-mounted slide of insect preparations. Photographs *about* carte size of the following:—portion of fern stem, coal section, leg and foot of blow-fly, antennæ of ditto, section of deal, etc., etc.—EDITOR.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

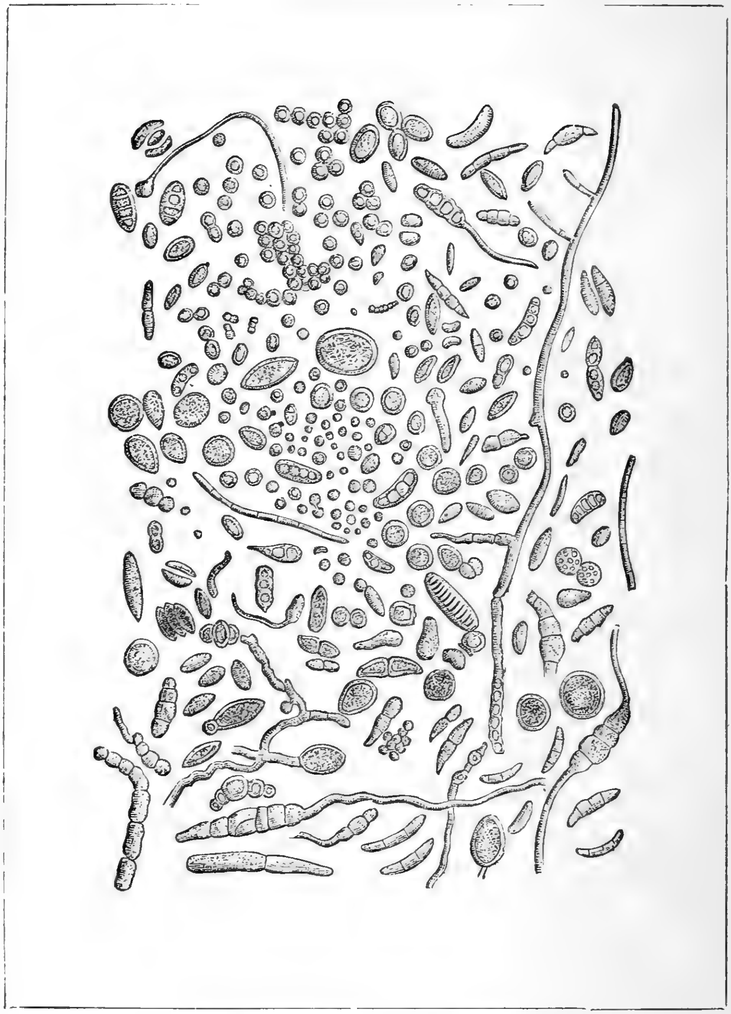
MICROSCOPE FOR SALE.—A good No. 3 binocular, by Browning, with ½ inch and ¼ inch objectives, by the same maker, and a pair of A eyepieces. Also achromatic condenser polariscope, camera lucida, Morris' stage, Selenite stage, and silvered side reflector, the whole in mahogany case, with box for apparatus, cost £26. What offers for this splendid working instrument?—Address, in first instance, to CHEMICUS, care of the Editor, NORTHERN MICROSCOPIST.

OBJECTIVE.—A fifteenth, by Dancer, 170° angular aperature, price £8. This is a splendid glass, the only reason for parting with it being that the owner is about purchasing a homogeneous sixteenth, and does not want both. A splendid glass for working at Bacteria. —X., care of the Editor.

MICROSCOPE STAND.—First class microscope (Beck's Popular) and apparatus, equal to new, cost £11, price £6 10s., bargain; also ⅛in. Beck, cost £5 15s. 6d., price £3 10s.—M., 28, Bartlett's-buildings, Holborn.

LICHENS.—The writer of the paper in the present number upon this subject is prepared to supply fasciculi of dried Lichen specimens, mounted and named, fifty in each bundle, price 15s. Also microscopic slides, illustrative of the Lichen thallus and the fruit organs, 10s. 6d. per dozen.—His address is Victoria Villa, Sunny Hill, Whitehaven.

Plate VI.



ATMOSPHERIC SPORES.

(Magnified 360 diameters.)

THE NORTHERN MICROSCOPIST.

No. 6. *JUNE.* 1881.

AERIAL SPORES.

Plate VI.

THE frequent occurrence of epidemic diseases, which have for a number of years been attributed to *materies morbi* in the air, and the possible connection which minute germs have with disease, renders it of extreme importance that the subject of aerial spores should be investigated in earnest.

There are many researches we can point to, bearing upon this subject, on the Bacillus of pneumo-enteritis by Klein, the researches of Professor Tommassi-Crudelli on the Bacillus of intermittent fever, Dr. Koch's researches and photographs of Bacteria in Septicæmia, Dr. Greenfield and McCarthy's work upon Pyæmia, Septicæmia, and Purulent infection, Pasteur's researches on fowl-cholera, and a number of others, which show that if these minute organisms are really the *causes* of the various diseases attributed to them, we should expect to find their germs in the atmosphere.

Researches upon this subject to be properly carried out, need rigorous attention to details, and the very various and conflicting results which have been arrived at, from time to time, show us that every precaution must be taken against contamination from extraneous sources. We must confess a doubt as to the accurate interpretation of results when time has been allowed to elapse between the collection of the specimen and its examination under the microscope. It is hardly possible to handle such subjects without exposing them to the air, and the additional operations of preparing, staining, and mounting are always liable to introduce errors.

Water always contains a great number of germs, and their presence in the condensed aqueous vapour of the atmosphere has been established by Lemaire and Gratiolet. It is true that Rindfleisch stated that aqueous vapour contained neither spores nor bacteria; but Billroth and Cohn have since proved that he was mistaken.

Being then by no means difficult in the staining and preparation of our objects to introduce the very organisms we are searching for, the above facts should always be borne in mind.

The "Preliminary Report of the Havana Commission to the National Board of Health," U.S., upon malarial or yellow-fever, contains the following:—"If there is any organism in the blood of yellow fever patients, demonstrable by the highest powers of the microscope as at present perfected, the photo-micrographs taken in Havana should show it. *No such organism is shown in any preparation photographed immediately after collection.* But in certain specimens kept in culture cells, spherical bacteria made their appearance after intervals varying from one to seven days." Another source of difficulty consists in the imperfection of our optical apparatus. Cohn expresses an opinion in these words:—"So long as microscope makers do not place higher powers at our disposal, without immersion; when in the domain of bacteria we shall still find ourselves in the situation of a traveller who wanders at twilight in an unknown country. The light of day no longer available to enable him to distinguish objects, he becomes conscious that notwithstanding all his precautions he is liable to lose his way."

The presence of organisms in the atmosphere seems first to have been mentioned by Ehrenberg in the year 1830; and, in 1847, he published his celebrated treatise upon the subject. The cholera epidemic in the year 1848 caused him to examine the dust deposited from the atmosphere, but as the higher powers of the microscope were not developed in his time, too much faith should not be placed in these and similar observations.

In 1849, some peculiar cells, stated to be due to the cholera fungus, was noised abroad by Swayne and Brittan, which caused the Royal College of Surgeons to appoint a sub-committee to examine the question, and they arrived at the conclusion that bodies presenting the so-called characteristic forms of cholera fungi are not to be detected in the air of infected places.

Dr. Dundas Thompson in the same year, with the co-operation of Mr. Rainey, collected solid particles from the air by aspiration through distilled water; but we have already pointed out that this method may be a source of error. About the same time Lord G. S. Osborne examined air by exposing slips of glass moistened with glycerine, over cesspools, gully holes, and other places near houses in which cholera appeared. He caught spores of fungi and minute germs which he termed "aërozoa."

The Rev. M. J. Berkeley, F.R.S., in his "Introduction to Cryptogamic Botany," published in 1857, makes allusion to the fact of the spores of fungi being wafted immense distances out to sea. Gigot, in 1859, published his "Recherches sur la Nature des Emanations Maricageuses," and Quatrefages, in the same year, recognised the presence of spores in great numbers. Pouchet then appeared on the scenes, and the result of his numerous

experiments with an "aeroscope," which he invented for the purpose, was to give as his opinion that spores and ova were infinitely rare in the atmosphere even in places where they should be expected.

In 1860, M. Pasteur made his appearance, and fresh light seems to have dawned with his *début*. By means of an aspirator he drew air through a plug of gun-cotton, and proved the existence of all kinds of spores in the atmosphere. Since this time, M. Pasteur has worked assiduously at this and collateral subjects, and has helped not a little to further the employment of the microscope in the investigation of the causes and nature of disease.

In America, we have Dr. Salisbury's investigation on the epidemic of intermittent fever which occurred in 1862 in the marshy valleys of the Ohio and Mississippi, in which he placed on record that having examined the saliva and mucus from the mouth and *nares* of the sufferers, he detected the presence of animalcules, diatoms, desmids, cells and filaments of algæ, and spores of fungi. Verily one of these poor patients must have been quite a treasure to a working microscopist.

Dr. Maddox, in the June number of the Monthly Microscopical Journal for 1870, had an admirable paper on the subject, which was illustrated by a drawing of the aeroscope he employed, and which was very similar in all points to that devised by Pouchet, but differed from this latter by the fact that the air current traversed the apparatus without the use of an aspirator as was used in Pouchet's instrument. In summing up he says, "Hitherto I found besides organic and mineral matters *(débris)* pollen grains, minute germs of various fungi, or protophytes, and excessively minute bodies, molecules, globules," &c. Now, although Dr. Maddox in his paper speaks of using the $\frac{1}{16}$th and $\frac{1}{20}$th objectives, yet the photographs, by means of which the paper was illustrated, were only magnified 43 and 118 diameters, powers entirely insufficient to show those minute organisms which are supposed to be of real importance with regard to disease.

Several other microscopists have worked at this subject; it is not necessary to mention each one individually; they have all in their turn helped to sway the balance to and fro. One finds bacteria in the air, and another tries immediately to disprove his statements, and all these quibbles have chiefly arisen from the fact that most microscopists who have essayed to experiment upon this most difficult subject have neglected those conditions which are necessary to scientific accuracy.

The observer who has left us some permanent record of what he has actually seen is Dr. Cunningham, and one of his drawings we have reproduced as Plate VI. It represents the spores collected by him during 24 hours from the atmosphere of Calcutta, on the 7th of August, 1872.

The series of drawings to which we refer are magnified 400 diameters, but it is stated in the text that powers of 800 and 1,000 diameters were employed *where necessary*. An inspection of the series which illustrate Dr. Cunningham's researches show us clearly that other than fungi spores are present in the air. Lichen spores and algæ spores are normal constituents of the air, and if we allow these why should we be so unwilling to admit the presence of Bacillus and Bacteria spores which are so much more exceedingly minute.

Whether these organisms are really the *causes* of the various diseases is quite another question, and in this connection an abstract of some work which has been done in this direction may be given on some future occasion.

DOUBLE STAINING.

By Arthur J. Doherty.

THERE are few microscopic objects which are more beautiful and interesting, and more worthy of a place in the cabinet than stained vegetable sections; and it is a matter of surprise, considering their great popularity, that the number of persons by whom they are prepared is, comparatively speaking, small. It appears, however, that this inequality is attributable, not to any difficulty in the art itself, but to the paucity of instruction; for it cannot be doubted that less has been written upon this subject than upon any other branch of microscopical study. Certainly Double Staining does not stand isolated from all other departments of the science by an entire absence of information regarding it, but the subject has nevertheless been treated upon only in such journals as one would not directly think of consulting with reference to it, whereas those works which ought manifestly to have exhausted the subject have dismissed it with a few words, or a chapter upon the staining of animal tissues only.

Perhaps the best paper which has yet been published on double staining is that which appeared in "Science Gossip" for January, 1880; but even the process therein described is in several points open to modification and improvement. It is in the hope, therefore, of supplying a want which must have been long felt that this article has been written; and though it would be perhaps presumptuous to say that the method here advocated is in anyway superior, or even equal, to many others which may be adopted, we believe it can be affirmed that it is the simplest and cheapest yet made public.

The art of staining in carmine and green consists of five stages or processes,—(1) decolourising the sections, (2) washing the same,

(3) preparing for staining, (4) staining in carmine, (5) staining in green. These processes will be described *seriatim.*

Vegetable sections may be bleached in various ways. When alcohol is used, no washing afterwards is necessary; but when acids are employed, all traces of the same must be entirely removed, so as to prevent crystallisation taking place after the sections have been mounted. But as there are objections to the use of alcohol, preference is to be given to a solution prepared in the following manner:—Dissolve in half a pint of water one ounce of fresh chloride of lime, and whilst the latter is in partial suspension, add about fifty drops of sulphuric acid.* Allow the solution to stand for about half-an-hour, or until all insoluble particles have entirely subsided, after which syphon off the clear liquid, and preserve in a stoppered bottle in a dark place. This latter precaution is imperative, because if the solution were exposed to the sun's rays its bleaching properties would be destroyed by a liberation of hydrogen which would combine with the chlorine from its state of inactive combination in the water.

After the sections have been bleached, which process it should be observed is completed when all colour has been demolished, they are to be washed in one or two waters and then soaked in a solution of sulphite of soda, composed of one part of sulphite to twenty parts of water, and finally washed in from ten to fifteen changes of warm water, for the purpose of removing any remaining traces of the reagents.

After this, in order to obtain deep colours, the sections are to be steeped in a mordant composed of ten per cent. solution of alum and water for twenty-four hours, at the end of which time they will be ready to be placed in the first staining fluid, the formula for which is as follows:—

Carmine	15 grs.
Ammonia	15 grs.
Water	2 ozs.

The carmine is to be dissolved in the ammonia over the flame of a spirit lamp, the water added next, and the fluid filtered through fine muslin before it is used.

Immerse the sections in this stain for six or eight hours, then take them out, and wash them in not more than two changes of water, and finally transfer them to the green stain, for which take,—

Aniline Green	5 grs.
Absolute Alcohol	1 oz.

* Hydrochloric acid would be better adapted for use than sulphuric, inasmuch as sulphate of lime, often difficult to get rid of, is not formed by this addition.—Ed.

Dissolve in a test tube with a slight heat only, so as to avoid any unpleasant mishap, and filter before using.

After a three hours' soaking in the above, the staining will be completed, and the sections should be mounted without delay.

Take them out of the fluid one at a time by means of Marsh's section spoon shown in fig 17, and place in a small saucer containing methylated spirit to wash the superfluous colour away. Then remove the section into another vessel containing oil of cloves, oil of cajeput, or benzol, and as soon as it becomes translucent, place it upon the centre of a warm glass slip, apply balsam and benzole immediately, and cover with a thin glass circle or square, and hold it down with a spring clip, as shown in fig. 18.

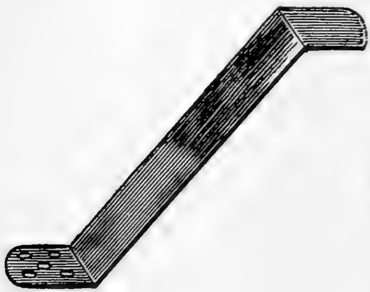


Fig. 17.

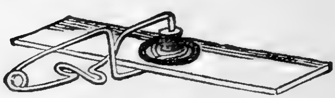


Fig. 18.

On finishing mounting, place the slides in a warm place to bake for a few days. The recess generally to be found above a kitchen oven forms a capital little bakehouse; but care should be taken that it is not too hot, or the balsam will be thrown into ebullition and the objects ruined.

Do not attempt to clean the slides until the balsam has throughly hardened, when it may be removed with the point of a pen-knife. The slides should then be ringed with brown cement, and the next day perfectly cleaned and polished by means of turpentine and warm water.

If it should be found that by following the above *modus operandi* a good deep carmine colour cannot be obtained, the strength of the mordant may be increased to fifteen per cent.; but if even after this, the carmine remain poor and faint, the amount of water added in preparing the stain should be diminished by about half an ounce.

In conclusion, it may be remarked that the sections should be handled with the greatest delicacy throughout, and in order to obtain good specimens a microtome is absolutely indispensable, a

good form of which is shown in fig. 19. This section-cutter is

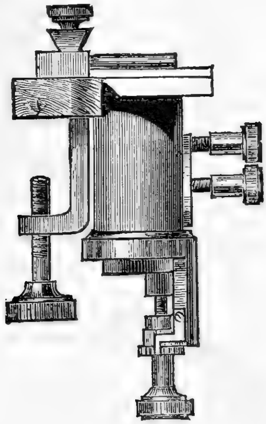


Fig. 19.

known as Hailes', and is sold by Messrs. Baker of Holborn. Not only are thick sections objectionable on account of their opacity, but they also offer great resistance to the total expulsion of air from their tubulous mass.

NOTES FROM LONDON.

DURING a recent visit to the South, we saw several contrivances, interesting perhaps to microscopists generally, which it may be useful to insert here.

One of these, suitable for botanical students, has just been issued by Mr. Browning, called Houston's Botanical Microscope, and which may be also used for general dissections, not requiring high powers. It is shown in fig. 20, and is exceedingly cheap.

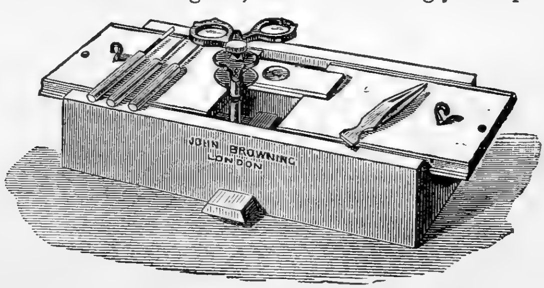


Fig. 20.

This ingenious little instrument (designed by Mr. D. Houston, author of "Practical Botany,") is intended to provide working botanical students with a convenient and serviceable Dissecting Microscope at a moderate cost.

The box measures, when closed, 9 inches long, 4 inches wide, and 2 inches deep, and is so constructed that, by using a divided sliding lid (which acts as a support for the dissecting stage), a rest for the wrists is secured while the hands are employed in dissecting.

The duplex lens, which gives three powers, magnifying 4, 6, and 10 diameters, is screwed to the end of a brass focussing tube which moves upon a brass pillar attached to a sliding bar at the bottom of the box. The lens may at any time be unscrewed and carried in the pocket.

The dissecting stage is a cork slide, plain on one side for general work, but provided with a shallow cell on the other, for the dissection of such objects as small glossy seeds which "fly" under the needles.

A pitted glass slide, to be used when the object is best dissected under water, is also provided.

A cutting needle, two dissecting needles, and a pair of small forceps are also included, and the whole is sold at the moderate price of six shillings and sixpence.

Mr. Browning has also produced a new form of binocular stand, which with substage fittings is selling for £25. The instrument is very similar to his best stand, and is constructed on the Jackson model.

We also saw some very beautiful wood-sections of exceptionally large size, cut by an amateur, who uses for the purpose an apparatus similar to the slitter of the lapidary. The sections were so thin that they seemed to comprise only one layer of cells, and were entirely unbroken.

Something quite novel was shown us in the shape of a new patent stand by Messrs. Watson and Son, of Holborn, an illustration of which we give as fig. 21. It will be seen that the new stand enables the observer to examine an object as he would if it were held in the hand, and viewed by the naked eye—that is, to turn it about in every possible way towards a ray of light proceeding in a fixed direction—and so, without once losing sight either of the light or the object, to observe its appearance when illuminated by light of every degree of obliquity.

This is the fundamental idea underlying its construction, and in this consists the great difference between it and all the old forms of stand (although it has all the uses of the latter), where the object remaining fixed, the only way in which its illumination can be varied is by moving the illuminating ray—which, in the amount

of accessory apparatus it requires, the comparative unintelligibility

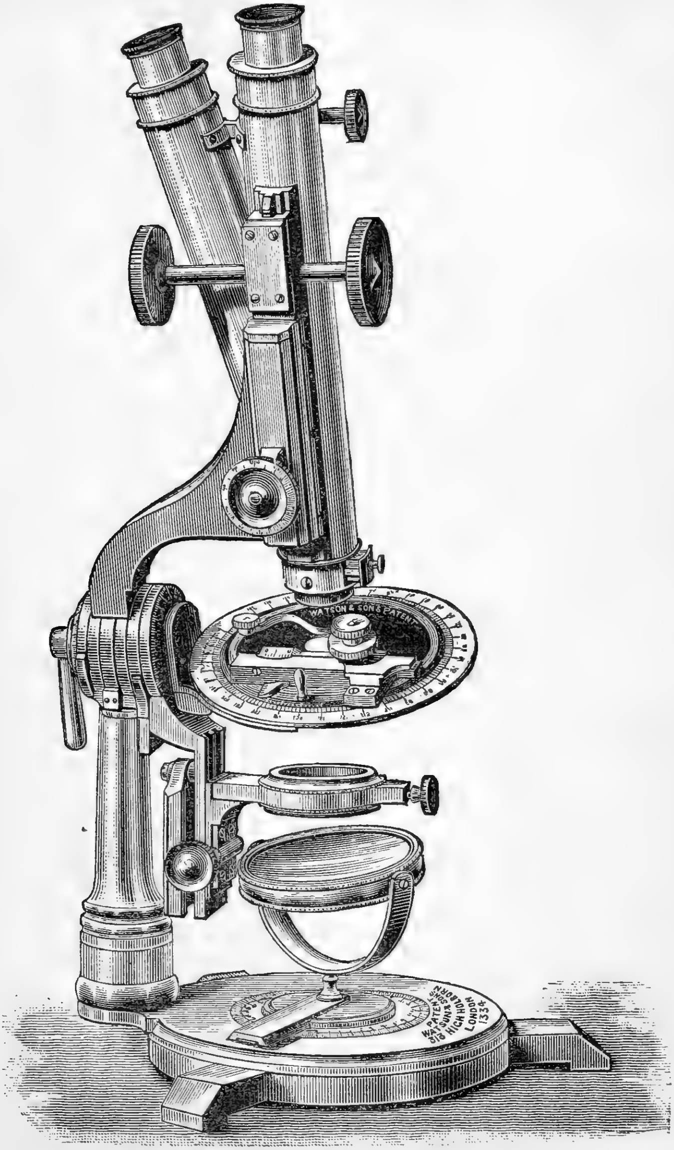


Fig. 21.

of the results it affords, and the amount of time it consumes, is stated to be in every way inferior to the new one.

An inspection of the engraving (fig. 21) will show how this idea is worked out. On the top of a strong pillar, to which it is attached by a massive cradle-joint allowing of inclination in a vertical plane, is fixed the arm carrying the body, which latter is provided with rack adjustment, and a new and improved fine adjustment, rendering unnecessary the usual often unsatisfactory loose nosepiece. The stage is so fixed with regard to the arm that the object when lying upon it is in a line with the centre of the cradle joint, so that upon inclining the body the object moves with it, and is presented at every possible vertical angle to a ray proceeding to it from a given direction. The stage is of a new and improved construction, being exceedingly thin—in fact the thinnest mechanical stage yet devised—and is capable of giving a complete rotation of the object.

Beneath the stage swings the substage arm, concentric with the object, and carrying the usual screw centering and rack adjusting substage.

Behind this substage arm is a strong bar, provided with a dovetailed groove, into which the mirror bar slides. This is so pivoted to the substage arm, as to allow the latter to be swung aside, and the mirror used alone when requisite, without the trouble of taking the substage away altogether. This is a great advantage, as it permits the substage, and any apparatus it may be carrying, to be swung into or out of position in a moment with the mirror in the position here indicated. The stand has all the uses of the old forms of microscope, and can be employed in exactly the same way, but even then its peculiar motions round the object as a centre give it very great advantages in every class of investigation. But it is when the mirror occupies the position now to be described that the peculiar properties of the new stand are brought fully into play.

The upright pillar, carrying the body and stage, is attached at its foot to a massive circular plate, carrying a graduated circle which rotates round a point exactly beneath the centre of the stage, and moving independently and concentrically with this is another smaller circle, having a dovetailed groove ploughed across it, into which the mirror bar can be slid when withdrawn from the substage arm. A spring catch attached to the dovetailed circle falls into a notch in the mirror bar when the centre of the mirror is exactly beneath the centre of the stage. This is the most useful position for the mirror, as a ray falling from a source of light upon it may be reflected upwards perpendicularly upon the object, when the body of the microscope is vertical, then without interfering again either with the mirror or lamp or interposing any accessory apparatus whatever, but simply by inclining the body the light falls

upon the object with a gradually increasing obliquity until, when the instrument is nearly horizontal, a perfect dark ground illumination can be obtained even with the highest power, while the gradual way in which the light becomes more and more oblique immediately under the eye, and the capability of arresting the inclination at that point where the most suitable illumination for the object under examination is obtained, give to the observer powers he has never before had at his command in any form of microscope yet produced.

The horizontal rotation mentioned above allows the object to be directed to the light at every angle in azimuth—to borrow a term from the astronomer—as the cradle-joint on the top of the pillar gives every angle in altitude, as the object occupies the centre of both motions by a combination of the two, it can of course be placed in every possible position. These angles are read—the latter by a graduated circle in the outerside of the cradle-joint, giving the inclination of the body to the vertical; the former by means of the graduated circle at the foot. Readings of these circles being taken with the mirror placed as above described at any time by so fixing the instrument that these circles read the same. Any desired effect will be exactly reproduced, *wherever the lamp may be placed*—a point of the greatest importance to workers with high powers.

There is a third divided circle on the substage axis, giving the inclination of the substage to the axis of the body. A strong clamp on the outerside of the cradle-joint holds the body firmly at any inclination, and a graduation on the slide of the coarse adjustment enables the working distance of the objectives to be measured and compared.

Upon this stand, and with one of their best $\frac{4}{10}$ths objectives, Messrs. Watson easily resolved in our presence *Pleurosigma angulatum:* not into lines merely, but into *dots* or hemispheres, which is rather a severe test for such an objective.

With these exceptions there appeared to be nothing really new in London.

NORTHERN SOCIETIES.

BOLTON MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER NATURAL SCIENCE ASSOCIATION. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER CRYPTOGAMIC SOCIETY meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER SCIENCE ASSOCIATION. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. NORTH OF ENGLAND MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. No Microscopical Society in existence.

NOTICES OF MEETINGS.

BOLTON MICROSCOPICAL SOCIETY.—On Friday evening, May 6th, an "open meeting" was held in the Lecture Hall, Mawdsley-street Schools. There was a numerous attendance which was presided over by Mr. T. H. Winder. After the transaction of the usual business of the society, an able and instructive lecture on "Parasites and Messmates," was delivered by the president of the society, C. L. Jackson, Esq., F.R.M.S., whose indefatigable energy in microscopical research is best known to members of the association, but is at the same time not unfamiliar to the outside public. The address was illustrated by sketches of parasites thrown upon canvas, by means of the oxy-hydrogen light, very efficiently manipulated by Mr. Shipperbottom, and also by specimens placed under a number of microscopes contributed by members of the society. Mr. Jackson proved himself to be well versed in his subject; his remarks, which were both instructive and amusing, showing that he had made the subject a special study. Parasites, he explained, were to be found in and upon all animated nature, not confined to the animal, but extending to the vegetable kingdom. They not only inhabited earth, air, and water, but they were to be found externally and internally in the human race. The lecturer, aided by the extraneous apparatus already mentioned, proceeded to describe the parasites which more or less assailed mankind, and then furnished ample proof that animals and fishes were subject to a similar kind of torment. The numerous illustrations, comical at times in their appearance, proved immensely pleasing to the audience and the company separated highly gratified with their evening's enjoyment within the region of scientific enterprise. Mr. Rideout, the hon. sec., exhibited a number of objects by means of a class microscope and a "dissecting microscope" contributed by Mr. Aylward, Strangeways. Manchester.

DONCASTER MICROSCOPICAL SOCIETY.—The eleventh ordinary meeting of the above Society was held on Wednesday evening, the 20th April, the Rev. Canon Brock (president), in the chair. Mr. Tindal was elected a member of the Society. Mr. Stiles (hon. sec.) then read a paper on the preparation and staining of wood sections. The procees of cutting these was fully described, and all details connected with it explained, both verbally and experimentally. Before being stained, wood sections require bleaching, and attention was drawn to the usual method of doing this. The purpose of staining is two-fold, not only is the natural beauty of the object greatly increased, but also its minute

structure is much more prominently brought out. Thus when two colours are used in staining a section of a young stem of oak, the woody portion of the stem will take one colour, and the pith and bark another, and this selection of colour is of considerable value in studying the structure and determining the constituents of a stem. The lecturer gave a detailed account of the processes of single and double staining in several colours, illustrating his paper by the exhibition of various objects treated in this way. The meeting terminated with a vote of thanks to Mr. Stiles, proposed by the president and seconded by Mr. Branson.

LIVERPOOL MICROSCOPICAL SOCIETY.—The fifth meeting of the present session was held at the Royal Institution, Colquitt-street, on Friday, May 6th. The president, W. Carter, Esq., M.D., gave a short account of the experiments and observations of Professor Tommassi-Crudelli, by which he had demonstrated that intermittent fever was due to the presence in the blood, of an organism of the genus Bacillus. He remarked that the experiments seemed to him rigidly to conform to the conditions demanded by scientific accuracy, and to establish beyond question the relation between the disease and the organism. The life-history of this latter had been carefully worked out; it had been shown to possess distinctive morphological and biological characters by which it was capable of being recognised; and by its introduction into the bodies of animals, living quite remote from malarious districts, typical attacks of ague had been induced. This was one of the latest examples of the successful application of microscopic research to the elucidation of disease. After this communication the following objects were exhibited:—

Acarus sacchari	Thomas C. Ryley.
Cordylophora lacustris	Charles Botterill.
Diatoms—various	Thomas W. Bruce.
Hydra fusca	Dr. McClelland.
Lophopus crystallinus	J. T. Norman Thomas.
Melicerta ringens	A. T. Smith, Junr.
Miscellaneous	Rev. Wm. Banister.
Canthocamptus minutus	H. C. Beasley.
Pond Life	H. M. Bennett.
Saprolegnia, &c. on dead fish	H. R. Boult.
Marine Polyzoa	J. T. Paul.
Flustra foliacea	William Oelrichs.

MANCHESTER MICROSCOPICAL SOCIETY.—At the monthly meeting of the mounting class in connection with the Manchester Microscopical Society, held in the board-room of the Mechanics' Institution, Mr. W. Chaffers was watched with considerable interest whilst performing the operation of extracting the palates from several specimens of the Dog-winkle, *(Purpura lapillus)* a creature very common on our coasts, and worthy of notice from the fact that from this animal was procured the famous purple dye of the ancients. The palate is a fine thread-like organ, extending from the mouth backwards into the body and stomach of the animal. In structure it may be described as a cartilaginous ribbon or toothed membrane, the teeth traversing the membrane in close-set rows the entire length of the palate, and as it becomes worn and unserviceable at one end is uncoiled and pushed forward at the other, to supply the place of the portion worn away.

Mr. J. L. W. Miles mounted some decoloured leaves in balsam, to show how simple and easy this operation really is when fluid balsam and benzole is used. Air bubbles, the great bugbear of tyros in mounting, and even to older hands, is simply the result either of nervousness, error in manipulation, or of inattention to the preliminary preparation of the object to be mounted. In Mr. Miles's opinion the application of heat should be avoided as being unnecessary and

mischievous, and in the mounting of such objects as marine algæ is quite out of the question. In this case the leaves were transferred direct from pure benzole to the cold slip, balsam added, and the cover glass put over and gently pressed down, resulting in a uniform absence of air bubbles in each mount. These slides were distributed to the members present.

Mr. W. Stanley exhibited an ingeniously-constructed mounting table made out of a cigar box, and as useful as the elaborate and somewhat costly table usually sold. It was an object of some curiosity and favourable comment.

The second excursion of the Bryological section of the Society was made to Marple. Proceeding by the canal bank *Weissia cirrhata* was found in fine fruit, and before leaving the footpath specimens were gathered of *Dicranum varium* and *fallax*, *Barbula revoluta*, *Didymodon rubellus*, and *Fissidens bryoides*. *Bryum capillare* was very plentiful, but in unripe condition. Leaving some of the members at Romiley to catch an early train, the rest went on by the printworks to Dan Bank, collecting by the way two species of *Tortula* and *Hypnum populeum*. At Dan Bank *Atrichum undulatum* was gathered, and also in splendid fruit the common but exceedingly interesting Jungermannia, *Pellia epiphylla*—the large-leaved scale moss—patches, in some cases many feet square, being covered with the small black globular capsules, on beautifully white and transparent peduncles or fruit-stalks. Under the microscope the dehisced capsules of these scale mosses present a very peculiar appearance, the spores being mixed with spiral threads called "elaters," which on the application of moisture twist and untwist, and seem to possess life. The presence of these elaters distinguish the Jungermannia family from the true mosses.

The ordinary monthly meeting was held in the Lecture Hall of the Mechanics' Institution, on Thursday, the 5th May; the President, Mr. John Boyd, in the chair.

Mr. G. S. Johnson, and Mr. Henry Kneebone were elected members of the Society.

Mr. John Smith, M.R.C.S., was prevented by a severe illness from reading his paper on the life history of *Cysticercus cellulosæ*.

A paper on *Trichina spiralis* was read by Mr. Dunkerley, being illustrated by coloured diagrams and prepared slides. After the reading of the paper, additional information was elicited by the discussion, in which Messrs. Doherty, Miles, Burnett, Dutton, Ward, Pettigrew, Scott, and the President took part.

Mr. Ed. Ward exhibited and described the uses of two new forms of the Pearson-Teasdale microtome. These are handy little section cutters, with moveable fittings, and for special work would be much appreciated by the microscopist. They are well made, and reasonable in price.

Mr. Aylward introduced a new form of a Dissecting and Mounting table. The table is well constructed of mahogany, with a glass stage and porcelain well, which also serves as a reflector. The lenses are supported in a carrier attached to a sliding tube, fitted with ball and socket joint. The price is moderate, and the table can be purchased either with or without the lenses.

Mr. Cook exhibited an ingeniously constructed Turn-table. Its mechanism is peculiar, for by the adjustment of two guages it will, on being revolved, describe rings of either a circular or oval shape. With a diamond point, it could easily be made available for the cutting of glass covers. Its price is necessarily much more than that of other tables.

In the Conversazione which followed, special and well-mounted objects were exhibited, as under:—

Diatoms	Mr. A. J. Doherty.
Foraminifera	,,
Sections—Stems of Exogens	,,
Cetochilus septentrionalis (from Llandudno)	The President.
Noctiluca miliaris	,,

Typical slide of Foraminifera *(Lagena)* 15 species represented by 60 individuals	Mr. H. C. Chadwick.
Marine Algæ	Mr. Alston.
Trichina spiralis in Pig, Rabbit, and Man	Mr. Dunkerley.
Young of Goby	Mr. E. Ward.
Timber infected with Dry Rot	Mr. R. L. Mestayer.
Fructification of Ferns	Mr. Miles.

On Saturday, May 7th, the members of the Bryological section had a pleasant excursion to Staley Brushes, under the leadership of Mr. James Cash. Upon reaching the first reservoir they were enabled, by special favour, to leave the public road and walk up-stream as far as the Swineshaw reservoir. Several notable species of mosses, &c., were observed. Numerous hepaticæ were found in perfect fruit, but the mosses, generally speaking, were out of season, and such as were gathered were hardly suited for cabinet specimens. It was, however, pleasing to observe *Tetrodontium Brownianum* and *Fissidens osmundoides* in one or two places. *Atrichum crispum*, which seems almost confined (in this country) to Lancashire, Yorkshire and Cheshire, was plentiful. *Hookeria lucens* and *Hypnum Borrerianum*—the latter, of course, in a barren state—were also gathered, whilst *Fontinalis squamosa* floated in long tresses in the stream. The company made a descent upon Hollingworth Hall, and after tea, returned to Stalybridge, and from thence by train to Manchester.

At the last meeting of the Manchester Microscopical Society's Mounting Class, the evening was devoted to wood section cutting, Mr. R. L. Mestayer officiating. It requires some little practice to successfully cut wood sections for microscopical purposes, and many are content to secure selected shavings after the use of a joiner's plane. This plan, however, is obviously out of the question when transverse sections of the stems of plants and trees are required for mounting. Slides of stem sections are very popular at present, and, in addition to being very beautiful objects, are of considerable educational value when properly mounted as permanent objects. To the uninitated the cutting of a piece of walnut or oak nearly an inch in diameter with one steady stroke of a razor, resulting in a section as thin as tissue paper, and of uniform thickness throughout, would appear almost impossible, but much of the difficulty is overcome if the wood is previously boiled or soaked in hot water for several hours, and a microtome or section cutter is used. After working for considerably over an hour in order that the members could see the various difficulties to be overcome, and after operating on a variety of hard and soft woods and tree stems, cutting longitudinal and traverse sections, Mr. Mestayer allowed the members to divide among themselves the sections for treatment and mounting.

This meeting practically brought the work of the class to a close. It is intended, however, to have an exhibition meeting next month, when members will show the result of their work and ability acquired since the class started. The success of this class having been so decided, it is more than probable another class will be formed for the coming winter months, previous to which Mr. J. L. W. Miles will read a paper on Microscopy to the members of the society, wherein he will touch as much upon various points of interest in connection with practical work as a short paper will encompass.

On Saturday afternoon, May 14th, the first ramble of the season by the members of the society in quest of pond life took place, under the leadership of Mr. J. L. W. Miles and Mr. J. Robinson. Although the weather was anything but favourable at the time of meeting, yet there was a fair gathering. The first place explored was the canal near to Gorton Station. Mr. R. Graham was the first to call attention to this being the local habitat of that beautiful fresh-water polyzoon, *Lophopus crystallinus*, and a careful search was made with the object of securing a few specimens, but without success, although they were

very plentiful last year. Several objects of interest, however, were produced, after which the party proceeded by the canal to the bridge terminating Hyde-road and leading to Denton. Crossing the bridge and taking a by-lane, the next search was made in a pond near to the Gorton reservoir. Here for a time the result appeared doubtful. The first object obtained calling for remark was *Hydra vulgaris,* and after the exercise of some patience sufficient were secured to furnish all with specimens. A special look-out was kept for that popular and beautiful tube-building rotifer, *Melicerta ringens,* but apparently none could be found. It frequently happens, however, that these minute creatures escape observation unless numerous until leisurely and carefully looked for at home; consequently all carried away Anacharis and duckweed for future investigation. All appearing satisfied with what had been done, the party soon after broke up, each taking the shortest route home. The following are some of the best known objects obtained as far as ascertained: *Melicerta ringens, Hydra vulgaris, Corethra plumicornis, Rotifer vulgaris, Stentor, Noteus quadricornis,* Vorticella, Epistylis, *Coleps hirtus,* Fairy shrimp (young), Daphnia and Cyclops.

MANCHESTER CRYPTOGAMIC SOCIETY.—At the usual monthly meeting, May 16th, Dr. Carrington, F.R.S.E., president, in the chair, Captain Cunliffe gave a report of a bryological excursion which had been made by a section of the members to the neighbourhood of Dolgelly and Barmouth, during the Easter holidays. Amongst the rarer species he mentioned and exhibited were *Plagiothecium Borrerianum, Hyocomium flagellare, Heterocladium heteropterum, Tetraphis pellucida, Mnium cuspidatum, Antitrichia curtipendula,* &c. After Captain Cunliffe had kindly distributed some of the species, Mr. Thomas Brittain exhibited a series of Lichens which he had mounted so as to serve for the herbarium as well as for microscopical investigation; he also reported that in a recent visit to Ireland he had found the rare *Æcidium calthæ.* Mr. W. H. Pearson had not had time to give a list of the hepatics found during the Welsh excursion, but he exhibited two species, *Scapania irrigua* and *Jungermannia capitata,* which had been found at Hastings, last month, by the Rev. E. N. Bloomfield. Mr. Cash reported the finding of *Tetrodontium Brownianum* at Staley Brushes during an excursion he had lately made in company of the members of the Manchester Microscopical Society. The Hon. Secretary exhibited a specimen of a new British moss, *Lescurea saxicola,* which had been discovered on Ben Lawers last August, by Mr. W. West, of Bradford, and another which had been discovered near Buxton by the same ardent bryologist; the species being *Gymnostomum calcareum.* Mr. Rogers also reported that he had now gathered the rare and pretty little fern, *Hymenophyllum Tunbridgense* on both sides the Great Cader Idris.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.—The usual monthly meeting of this society was held on Thursday evening, April 7th, at Facit. The chair was occupied by the president of the society, Dr. J. H. Worrall, J.P., of Bacup. There was a good attendance of members. The ordinary business of the society having been transacted, Captain J. Tertius Wood read an excellent paper on "Fossil Botany," illustrated by diagrams and 48 microscopical slides of his own preparation. He gave it as his firm conviction that the *Hallonia* is the fruiting branch of the *Lepidodendron,* and though the former is generally found devoid of its outer cortex with the leafscars, he stated that he has found one that in every respect exhibits the Lepidodendroid character, and is quite in opposition to anything that may have been conceived as to its being the root. Among the slides bearing upon the subject were to be found *Calamites, Stigmaria, Sigillaria, Lepidodendron, Ligenodendron, Diploxolon, Calamostachys,* and *Bimara,* shewing spores and several ferns of the *Rachiopteris* family. An entertaining and instructive discussion followed the paper, after which the meeting resolved itself into the usual conversazione.

NOTES AND QUERIES.

Mosses.—In reply to *Capax* as to mounting mosses, the names of books, prices, &c., I am sorry to say that there exists a great dearth of such works. There is Stark's "History of British Mosses," published by Routledge at, I think, 7s. 6d., which is a very good book for a beginner, as in the appendix a few hints are given as to their collection and preservation for the herbarium. There is nothing, however, about mounting them for the microscope. I mount mine as follows:—Soak the moss in a mixture of equal parts of water and glycerine for twenty-four hours, take out and drain on blotting paper, place on the centre of the slide with a drop of glycerine jelly (Rimmington's I prefer), put on the cover glass and spring clip and hold over the chimney of a paraffin lamp until the jelly is in a state of ebullition; remove and cool quickly, clean off the superfluous jelly with the point of a knife, and afterwards with a wet cloth. Finally the glass circle should be ringed with black varnish, or any other kind of cement.—*Bryo.*

Leaf Fungi in June.—The month of June is exceedingly rich in leaf fungi; many of the most beautiful of them may be met with during the entire month. The Æcidiacei are especially plentiful, but only a few of them are within easy reach of Manchester. I have found the coltsfoot cluster-cup, *Æcidium compositarum*, var. *tussilaginis* on the banks of the Mersey near Northenden, and also in Miller's Dale. The *Æ. compositarum*, var. *lapsani* may be found in Bramall Valley, near Chorlton-cum-Hardy, and elsewhere. The *Æ. epilobii* is now found in fine condition on Epilobium *ursuta*, and *montana* along the margin of the river in the Buxton Valley, especially in Miller's Dale. The *Æ. bellidis*, the daisy cluster-cup, I have only once found in the district, and that was on the mountain, north of Buxton. The dandelion cluster-cup, *Æ. compositarum* var. *taraxaci*, I have but once found within reasonable reach of Manchester; it was on the road leading from Miller's Dale to Taddington. In the south this fungus is very plentiful. The *Æ. violæ* may now be found in many localities within six miles of Manchester. The neighbourhood of Bramhall was, a few years ago, a good hunting ground for this fungus. A few years ago I met with *Æ. aviculare*, knot-grass cluster-cups, on rubbish heaps in a clay pit at the bottom of Lloyd-street, Greenheys. The spot is now completely covered by houses. This is a rare fungus, and I have never since had the good luck to meet with it. The goat's-beard cluster-cup is very plentiful during the month, on raised banks within two miles of Southport, and elsewhere. There are others which are in beautiful condition at this time, but I have never found them nearer than the Lake district, amongst them the

nettle cluster-cup, *Æ. urticæ*, *Æ. grossularia*, on the gooseberry *Æ. leucospermum*, on the wood anemone. Students, taking their summer holidays, should look out everywhere and they will almost for a certainty be rewarded for their trouble.

Numerous Pucciniæi now for the first time begin to show themselves, but, for the most part, they live far away from Manchester, nevertheless they should be looked for, and new localities should be remembered, and information sent to the Editor of the NORTHERN MICROSCOPIST. It is in this way valuable help may be given to microscopic students. About twelve years ago I met with a fungus in the Bollin Valley, near to Wilmslow, which was unknown in Britain. It was in the form of small spots of black smut on the under side of the leaves of the butterbur, *Petasites vulgaris.* I sent specimens to Dr. Cooke, who referred to it in his publication, "Grevillea," vol. i. p. 40, and named it *Badhamia capsulifer.* Long after that date, in vol. v. p. 12, he refers to the plant again, and names it *Physarum tussilaginis.* Every summer in June I have found this same fungus in various parts of Cheshire, near the various brooks and rivers, but never in any other part of England. I have endeavoured to find out through "Science Gossip" if any other person has found the fungus, but I have not yet heard of any one who has done so. It is one of the Myxogastres, and is of especial interest at the present time, when one of our scientists is claiming for this family a relationship with the animal kingdom. I would urge upon botanical students to be on the look out for this interesting fungus, for I have a strong opinion that it may be found in other parts of the country besides the Cheshire valleys.

The cluster-cup on the garlic is rare, but very beautiful, and should be looked for carefully. I have found it but once, and that was in June, on the west shore of Windermere Lake.—*Thomas Brittain.*

P.S.—Since writing the above, it has occurred to me that *Puccinia umbelliferarum* may be met with in numerous localities near Manchester in June. It is very common on the pignut, "*Bunium flexuosum*," but it may be found on various umbelliferæ. I have met with it near Wilmslow, in Bramhall Park, and numerous other places.—*T. B.*

BOTTERILL'S ZOOPHYTE TROUGH consists of two brass or ebonite plates bolted together, as shown in fig. 21, the plates of glass being separated, according to the thickness required, by an ordinary india-rubber ring of the requisite thickness. The trough can thus be taken apart and the glasses cleaned, or a broken front replaced without the trouble of cementing, the glass sides being sufficiently thin to allow the use of high power objectives.

The advantages to Microscopists of this Trough over every other hitherto introduced must be at once apparent. By adding a little water (by means of a pipette) every day or two, to supply the loss

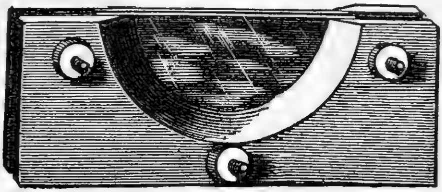


Fig. 22.

caused by evaporation, minute forms of Infusoria can be watched for weeks and their development traced. For the larger forms of pond life this Trough is no less useful—Melicerta, Floscularia, &c., &c., living in it for weeks without removal. Microscopists are thus able, by keeping a few Troughs in use, to place a variety of living specimens at once under the Microscope without trouble or loss of time.

Movements of Diatoms.—At a recent meeting of the Royal Microscopical Society, a communication was referred to, on the movements of diatoms, in which the views of M. Mereschkowsky were controverted.

The President said if they wanted to see diatoms to the best advantage, they must see them under natural circumstances. If they were put upon a slide with a glass cover over them, the water became chilled, and their movements were to a great extent stopped; but if the slide was warmed, their activity was increased to a much greater degree than usual. Under proper conditions, with a 1-16th immersion objective, he had distinctly seen the wavy movement of the protoplasm, but the impression was strong upon his mind that there was something else concerned in the movement in addition to this. It struck him that some of the movement was produced by the action of heat-currents in the water, for the things were so light as to be most easily influenced in that way; from his own observations he must consider it to be due to more than one agency.

The Cloth Moth.—*Tinea tapetzella* is one of those Tineidæ which sometimes do a great deal of mischief in houses. The larva constructs for itself a protecting tube from the fibres and small pieces of the stuff it delights to gnaw. After a time the caterpillar closes one end of its tube and attaches it to some fixed body; it then becomes metamorphosed, the chrysalis eventually

becoming a moth of a silver grey color with a white spot on each side of the thorax.

Brownian Movements.—At a recent meeting of the mounting class of the Manchester Microscopical Society, Mr. R. L. Mestayer exhibited a fluid mount of gamboge, showing that singular phenomenon known as "molecular movement," which all practical microscopists are acquainted with, but occasionally occurring under circumstances calculated to lead students astray in their inferences. This slide was put together fifteen years since, yet the particles of gamboge continue their course as merrily as ever.

Photographs of Bacteria.—In the *Photographic News* for August, 1880, mention is made of the photo-micrographs of Bacteria produced by Dr. Koch, in the following words :—

"The photographs are transparencies executed in a most perfect manner, and capable of being thrown upon the screen at a lecture for instructional purposes. They represent the animal tissue of mouse, rabbit, &c., after the animal had been punctured with a needle to permit the entrance of bacteria and the spread of blood poisoning. Let us examine the first of the series. Here are little round globules hanging thickly upon threads of cobweb, like tiny currants or grapes; they are the bacteria of the deadly gangrene, and as they advance all hope for the patient dies away. Here, in the next slide, is the articulated bacteria, like a tape worm or bit of jointed glass; and here the thin hair-like organisms that are the cause of relapsing fever. There are a score of pictures in Dr. Koch's series, and they all have their vital—or shall we say deadly? —history. The spores of the bacteria are even more minute."

Reaping his reward.—The following paragraph has been going the round of the Northern papers. If true, it does not say much for the liberality of the University which has not been backward in accepting the results of this poor man's toil.

"The extensive collection of botanical specimens gathered by John Duncan, the "Alford weaver," whose life was sketched in *Good Words* by Mr. Jolly, has been presented to the University of Aberdeen. It contains no less than 1,131 plants indigenous to Britain, many of which were obtained by their collector by moving about as a *harvester* over the southern districts of Scotland and the north of England. It is stated that this self-educated devotee of science, whose efforts recall those of Dick and Edwards, is now in his extreme old age dependent on parish relief."

Exhibition of Instruments.—The British Association will have an exhibition of scientific instruments during the forthcoming meeting at York. The object is to show, as far as possible, the progress which has been made during the past half century in the construction of instruments used in scientific research.

Homogeneous Immersion.—At the April meeting of the Royal Microscopical Society, Mr. Powell exhibited a new $\frac{1}{8}$th homogeneous immersion objective of numerical aperture 1.47 or 150° balsam angle. While on this subject we should like to call our readers' attention to the April number of the Journal of the Society, which is most interesting to all microscopists who wish to understand the subject of "angular aperture."

Atmospheric Dust.—On the morning of the 27th of March last, a deposit of reddish-yellow dust fell at Catania in Sicily. Very strong south-west winds had blown for several days previously. The dust continued to deposit during twenty-four hours, the sky was covered with clouds, and a thunderstorm was anticipated; all day a fog hung in the air which was painful to the eyes, and next day the leaves of trees were found covered with a fine powder like brick dust.

A Sliding Stage-diaphragm.—At the seventh meeting of the present session of the Royal Microscopical Society, a paper was presented by Dr. Anthony on the above subject. Mr. Beck very properly described the plan "as old as the hills." We have used a diaphragm made from a sheet of blackened aluminium for the past eight years, and upon this the object slide is placed. Mr. Crisp added that of late years the importance of using the diaphragms immediately beneath the object had become more and more recognised.

An Insectorium.—A remarkable and novel feature has been added to the London Zoological Gardens in Regent's Park, in the shape of an insect-house, wherein the entomologist, Mr. Watkins, is forming a carefully-chosen collection of creeping and flying things. The insectorium is already rich in beetles with burnished wings, in butterflies which glitter in gold and purple, in curious water insects, and industrious spinners of silken threads. The chrysalids are shown in life on the boughs in a box below, and till the perfect insects emerge from the plain cocoons in their beauty of painted wings, dried specimens of the same are placed above.

Development of Flowers.—At a recent meeting of the Pendleton Field Naturalists Society, Mr. Thos. Whitelegge, of Ashton, read a paper on the Development of Flowers. Plants, he said, have two modes of reproduction, viz., sexual and asexual. In the higher cryptograms the antheridia and archegonia are either on one or two organs. Mosses continue to produce flowers for several generations, but ferns only do so once. The prothallus soon dies. In the Jersey fern, however, the prothallus is persistent, living after the fern dies. The capsule of the moss is the only part that has stomata. Selaginella produce two kind of spores, the macro and micro spores, the larger producing archegonia, and the smaller or

micro spore produces antherida. In Selaginella the rudimentary prothallus consists of one cell only. In lycopods we get two prothalli from one spore. In the Coniferæ or Pine family the pollen is born on the under surface in pollen sacs, and the grains are two to four-celled. The Coniferæ form a connecting link between the flowering plants and cryptograms. In the ovules of many of the higher plants are found what are termed antipodial cells, and which are supposed to represent the prothallus of the lower plants, and quite recently the pollen grains have been found to undergo division into two or more cells, the largest forming the pollen tube, and the others assimilating food for the prolongation of the tube, thus forming a rudimentary prothallus. Generally speaking, the sexual organs, whether of the lower or higher plants, are but modifications of the same structure.

The paper was illustrated by diagrams and microscopic sections of the different parts referred to.

Permanent Eye-pictures.—After the so-called "visual purple" was discovered by Prof. Bell, and it was found possible to produce pictures on the retina, which might be examined after death of the animal, the possibility of obtaining such pictures, produced during murders, &c., was discussed. In a recent article in the New York *Medical Journal*, Dr. Ayres, who made over a thousand experiments in taking "optograms" on the retina of animals in Prof. Kühne's laboratory at Heidelberg, comes to a negative conclusion on the point. While working in the laboratory, Professor Kühne proposed that he should make a picture of Helmholtz and send it to the latter in acknowledgment of the value of his researches on physiological optics. Dr. Ayres, therefore, got a large negative of Helmholtz, and placed it over the eye of an animal, which had been dosed with atropine. The animal had been in the dark room for hours. The sun was shining brightly, and every precaution having been taken, the retina was exposed for four minutes. There was a dull picture on the cornea, and when the retina was examined there was found an image of Helmholtz's shirt-collar and of the end of his nose. The light transmitted through the negative was not sufficient to bleach the visual purple. As the purple is rapidly regenerated in the living retina, and may have been restored in this case as fast as it was bleached, Dr. Ayres cut off the head of a rabbit, and waited till all such power in the retina was certainly lost. Then he repeated the experiment. The result was a little better, but the optogram was by no means distinct enough for one to recognise even that it was intended for a picture. Dr. Ayres therefore concluded that an optogram could not be so obtained. He believes it utterly idle to look for the picture of a man's face, or of the surroundings, on the retina of a person who

has met with a sudden death, even amid the most favourable circumstances.

FLAGELLATE INFUSORIA.—Dr. E. Cutler describes a flagellate infusorium called *Asthmatos ciliaris*, which occurs in connection with one form of contagious cold coryza or influenza. These parasites may be easily detected in the early sneezing stage, when the nose and the eyes run water; they are located in the anterior nasal passages, on the mucous membrane of the conjunctiva of the eyes, and of the pharynx and larynx. Simply transfer a drop of the thin mucus to a slide, cover, then examine with a good 1-5th objective and 1 inch ocular.—*Science.*

RAULIN'S FLUID.—For the culture of micro-fungi this is the best liquid extant. Pasteur in his experiments used the ashes of yeast, but his chief assistant, M. Raulin, prefers the following:—

Water	1500	grammes.
Sugar candy	70	,,
Tartaric acid	4	,,
Ammonium nitrate	4	,,
,, phosphate	0·60	,,
Potassium carbonate	0·60	,,
Magnesium ,,	0·40	,,
Ammonium sulphate	0·25	,,
Zinc ,,	0·07	,,
Iron ,,	0·07	,,
Potassium silicate	0·07	,,

For those unacquainted with the French system of weights and measures it may be useful to add that grains may be weighed off instead of grammes.

THE LATE M. NOBERT.—Microscopists of the future have M. Nobert's legacy, to resolve the lines on his last test plate. His 19 band plate, ruled on a 3 × 1 slip, contains lines numbering from 11,000 to 112,000 to the inch, and may be obtained from Mr. Wheeler, of Tollington Road, at the price of £8. Nobert often expressed his opinion that the last four bands of this plate would never be resolved by any objective; but after inspecting Col. Woodward's photographs of the whole series of bands, he set himself to work to make a new plate upon which he ruled 20 bands, commencing with 11,000 lines to the inch, and ruling the twentieth at the rate of 200,000 in the same space. The lines on the 10th band of the new plate correspond nearly to the 19th band upon the old plate. The new plate can also be obtained from Mr. Wheeler, the cost of which is £15.

ERRATA.—On page 123, in *Pond-life*, line 26, for "Vorticellœ," read "Vorticellæ," and for "Botifers," read "Rotifers."

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

R. G.—The errors in your paper were the fault of the printer. We have called attention to the matter in our "Notes and Queries."

J. C. C.—We shall be glad to receive communications relating to microscopical matters from any of our subscribers.

D. B., R. H., J. C.—Distance from London, and other causes, may delay for a day or so the delivery of "The Northern Microscopist"; but you should receive it by the 3rd inst.

H. H.—Your letter shall be inserted in our next. It was too late for insertion in this number. See notice as to date.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

CHALLENGER DEEP-SEA SOUNDINGS.—Ten well mounted and correctly named, in exchange for other good slides.—Send list to A., 215, Bordesley Green, Birmingham.

MERIDION CIRCULARE.—Mr. W. Swinburne, Yeathouse, Frizington, viâ Carnforth, will gratuitously forward this diatom on receipt of stamped address with sealed quill or tube.

PHOTO-MICROGRAPHS.—A photograph, much enlarged, in exchange for a well-mounted slide of insect preparations. Photographs *about* carte size of the following:—portion of fern stem, coal section, leg and foot of blow-fly, antennæ of ditto, section of deal, etc., etc.—EDITOR.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

MICROSCOPE FOR SALE.—A good No. 3 binocular, by Browning, with ½ inch and ¼ inch objectives, by the same maker, and a pair of A eyepieces. Also achromatic condenser polariscope, camera lucida, Morris' stage, Selenite stage, and silvered side reflector, the whole in mahogany case, with box for apparatus, cost £26. What offers for this splendid working instrument?—Address, in first instance to CHEMICUS, care of the Editor, NORTHERN MICROSCOPIST.

OBJECTIVE.—A fifteenth, by Dancer, 170° angular aperature, price £8. This is a splendid glass, the only reason for parting with it being that the owner is about purchasing a homogeneous sixteenth, and does not want both. A splendid glass for working at Bacteria. —X., care of the Editor.

OBJECTIVES.—A half-inch, also a one inch object glass, by Dancer of Manchester. What offer, cash?—J., care of Editor.

AIR PUMP.—A four-inch air pump, by Collins, without receiver. Offers requested. B. D., care of Editor of NORTHERN MICROSCOPIST.

The Northern Microscopist.

No. 7. *JULY.* 1881.

DYTISCUS MARGINALIS. THE GREAT WATER BEETLE.*

By W. Rideout, F.R.M.S.

A POND is to its inhabitants what the world is to us, and a very interesting world it is, not only to its own denizens, who no doubt consider it (whatever fault we may have to find with it) the finest place under the sun; and wisely so, for "where ignorance is bliss 'tis folly to be wise." But some may say, "What do you find in ponds except mud, dead dogs, and duck-weed?" The answer is, "Life!"—life in all its diversity of forms, beautifully and wonderfully arranged; each individual deriving benefit from the well-being of the mass, the mass often prospering in inverse ratio with the individual. To the microscopist a productive pond is simply a world of wonders. Here he finds minute forms of life beautiful in the extreme, and admirably adapted for the life they lead. If the visitor to the pond side does not happen to be a microscopist, then he will find ample amusement and instruction in watching the larger creatures which inhabit its waters, such as frogs, newts, beetles, and fish, each presenting peculiarities well worthy of his close attention. I have selected for consideration a common inhabitant of our ponds and rivers, *Dytiscus Marginalis*—sometimes spelt Dyticus—the Great Water Beetle, or Water Devil (fig. 23); who, judging from the way in which he comports himself when removed, evidently considers it his private property, bagging his game as opportunity offers, in fact sporting seven days to the week, and resisting any attempt at capture by all the means in his power.

Of *Dytiscus marginalis* may be said, as was said of a large sample of humanity long ages ago, that he is a warrior from his youth up,

* A paper read before the Manchester Scientific Students' Association. The illustrations have been prepared by photographing the actual specimens exhibited by Mr. Rideout.

and apparently he is a formidable check to over population, for where he is to be found in large numbers, fish and newts have a lively time, for he seems to delight in a war of extermination so far as his inferiors are concerned. Before proceeding to examine the beetle in question it will be necessary for a thorough comprehension

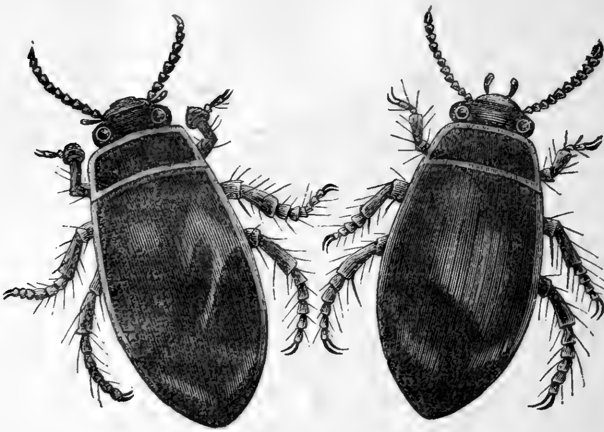


Fig. 23.

of the subject to glance at the leading features of insects, in which class the beetle family holds the first rank.

Insects may be described as articulated animals, breathing by means of tracheæ, and divided into three distinct portions, viz., the head, the thorax, and the abdomen; passing through a series of transformations, and having in the perfect or winged state six articulated legs and two antennæ. The bodies of insects are formed of a series of rings, within which are contained the muscles and vital apparatus.

As I have just stated, insects are articulated animals, breathing by means of tracheæ. Now, the tracheæ are tubes composed of two thin membranes, kept open by a fine but stiff wirey thread, which is twisted spirally between the two coats throughout the whole course of the tube. This arrangement keeps the tube open, however much it may be twisted or bent. The breathing apparatus is not specially consigned to any portion of the insect as is the case with the lungs in man or the gills in fish, but it permeates the whole structure of the insect, passing through the limbs, and even reaching to the claws. The trachea, fig. 24, will illustrate this spiral thread, which in its convolution is so curved as to give the appearance of watered silk. It is the main portion of the trachea, consisting of a cylindrical tube, with smaller tapering tubes leading

from it. The largest tubes are those which run along the sides of the insect and open into what are known as "spiracles," or breathing pores. The spiracles through which the air enters the tracheæ are generally visible on the abdominal segments of the insect, as a

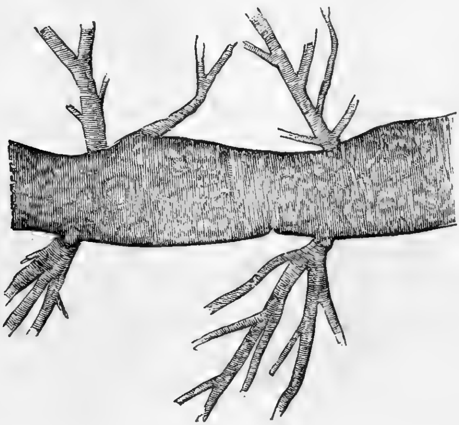


Fig. 24.

series of pores along the margin of the under surface. In the larva each segment is provided with a pair of spiracles, but in the perfect insect several in the thoracic region remain closed, and so the number is reduced. The spiracles, generally speaking, are furnished with some kind of sieve at their entrance by which particles of foreign material are kept out, which would soon, if allowed to enter, silt up the tubes. A spiracle may be seen in fig. 25.

The second portion of the definition of an insect was, that it must be divided into three parts, viz., the head, the thorax, and the abdomen. We may now notice the transformations which the insect undergoes before reaching the adult state. First, we find the egg, then the larva (the caterpillar or grub), the pupa (or chrysalis), and the imago, or perfect insect. The two phases of existence which are most readily observed, and which are certainly the most interesting, are the larva and the imago or perfect insect. The larva is made up of a number of segments enclosed in a series of double half rings, joined at their margins by a membrane. The larva casts its skin several times as occasion requires, for he seems to do nothing but eat, and as he increases in size he expands his coat to the uttermost till it arrives at the breaking strain, when it gives way and the larva emerges enveloped in a new skin which has been forming under the old one. The whole growth takes place while the creature is in a larval state, for the perfect insect does

not increase in size. All true insects have six legs when they have attained their perfect form. Sometimes a casual observer might doubt this, for only four are observable, but if careful search is made two others of a rudimentary description will be found. The

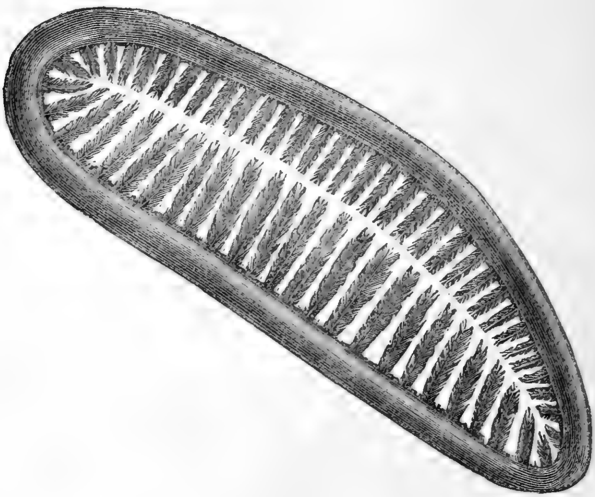


Fig 25.

antennæ or "feelers" may next be noticed, for they frequently give great character to the appearance of the insect. In some beetles they are slender and long, as in the *Dytiscus marginalis*, but in others they are short and club-shaped. *Dytiscus marginalis*, being a beetle, belongs to order "Coleoptera," because it has very strong leathery wing-cases, useless in flight, but serviceable in protecting the true wings from injury. These are termed Elytra, and when exhibited under polarized light make a pretty object.

We may now glance at the anatomy of a beetle. Any beetle will answer the purpose. Beginning with the *cephale* or head, the first portions which we notice are the *mandibles*, which will be seen to be a formidable pair of forceps, calculated not only to seize but to hold the prey when it is seized. The next are the antennæ, consisting of two parts, the *scape* and the *club*. This appendage undergoes various modifications in the different beetles, but the general structure remains the same. Again, we have the *labial palpi*, or lip-feelers, and the *maxillary palpi*, or jaw-feelers; the anterior pair of legs, consisting of the *tarsi*, or feet, the *tibia*, or shank, and the *femur*, or thigh; the portion by which the *femur* is united to

the thorax being known by the name of *coxa*. The plate joining the *coxa* to the *femur*, or more correctly the plate covering the junction of the two, is known as the *trochanter*. The anterior pair of legs is fitted with an apparatus of a very wonderful kind in the *Dytiscus marginalis*, for not only do the *tasri* end in a pair of formidable claws, but a circular enlargement is found fitted with two large suckers, these being supplemented by a large number of smaller ones having trumpet-shaped mouths. The effect of these is easily seen. When once the beetle seizes a fish or other object which he wishes to kill, the suckers are at once applied and he is as it were glued to his prey, and no amount of wriggling will shake him off. This portion of the insect is shown in fig. 26, and its

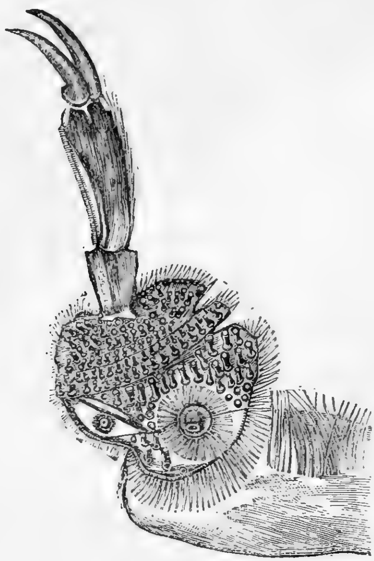


Fig. 26.

structure will well repay attention. At the upper surface of the head, the protecting portion in front is known by the term *clypeus*, or shield, the upper central portion is the *vertex*, or *crown*, the circular parts represent the eyes, while the back part is termed the *occiput*. On the under side of the head the eyes are represented by circles, while the depressions in front show the insertion of the *antennæ*. The front portion of the upper side of the thorax is termed the *anterior margin*, the angular points in front being known as the *anterior angles;* the posterior margins and posterior angles being nearer the abdomen. The main plate of the *prosternum* or under surface of the thorax is known as the *sternum*, while

the two hollows show the insertion of the *coxæ*. Then there is the *meso-thorax* and upper portion of the abdomen, and the *metasternum* and abdomen (under surface), on the margin of which we notice the *parapleura* or side pieces, while in front we find the *episterna* or breast pieces. As the wings are above the abdomen, we may notice the appearance of the wing when folded and when extended.

We may now notice the *scutellum* or shield. You will remember that I termed the projection in front of the head the *clypeus* or shield. Both terms are borrowed from the Latin. The *clypeus* was a small circular shield used by the Roman foot soldiers, while the "*scutum*" was a larger shield and of a different shape, used by cavalry as well as infantry. The chief objects of interest here are the *elytra*, or wing cases. The point nearest to the *scutellum* is called the base, while the pointed end is known as the apex. The *elytron* forms (as I mentioned before) a pleasing object when viewed by means of polarized light. The parts of the intermediate and posterior pair of legs are similar to the anterior pair; but in the water beetles they assume the form of swimming paddles—being flattened, the margins being thickly set with hairs which contain air, and besides rendering the body lighter afford a store for respiration. The next point to notice is the folding process of the wings, by means of which arrangement they are safely stowed away in small compass when not required. The eye of the beetle is well worthy of notice, being compound and composed of a large number of facets; but, although these facets give a great advantage to the beetle in seeing all around, yet it must be remembered that only one image is conveyed to the brain. The thorax bears all the instruments of locomotion, both legs and wings, and these work in strong processes which give them needful support,—the power of motion being derived from sets of powerful muscles wonderfully adapted for their work.

As we find rapacious animals inhabiting the earth, and carnivorous creatures inhabiting the sea, so we find a similar division of the beetle family; carnivorous beetles living on land, and others with similar tastes inhabiting the water; or, as our great poet expressed a similar idea:—"There be land rats and water rats, water thieves and land thieves;" and as the Dytiscus happens to ply his daily avocation in the water, he belongs to that class of beetles known as the "Hydradephaga" or carnivorous beetles of the water. The word Hydradephaga is derived from two Greek words, meaning water-eater. We notice in the animal world generally, that natural provision is made in various ways to enable creatures to obtain food according to the circumstances in which they are placed; and innumerable modifications of limbs and other parts of the body take place, in order to fit them more suitably

for the business of life. Similar modifications are found in the beetle family. The wing-cases fit closely at the margins and enclose air underneath, enough to supply the tracheæ for some time when under water.

The shape of this beetle is much more fish-like, and presents a smooth surface to the water, thus lessening the friction, which is much greater in the water than in the atmosphere. The legs are much modified, the anterior pair being small but well armed, the intermediate pair are much smaller also than the corresponding pair in a land beetle. A marked difference is found, however, in the posterior pair, which in land beetles are about the same size as the pair in front of them; but in the *Dytiscus marginalis* they are about three times the size of the intermediate pair, being flattened and edged with strong hairs, to be used as swimming paddles, the flattened surface and the hairs converting each into the blade of an oar.

Another feature worth notice is the position of these swimming paddles which are placed well back, as are the flappers of seals and diving birds. The attachment is of such a nature as to allow the utmost possible space for the powerful muscles which work them. While every provision is made for the best means of locomotion, you will notice that, although much reduced, the formidable claws are present in the intermediate and posterior pairs of legs as well as in the anterior, being found both in the male and female. The wings as we have seen, are large and powerful, and of great service in transporting the owner to new hunting grounds, for food must often fail in one pond if they exist in great numbers, owing to their rapacity. They are pretty fairly distributed over the country, though in some districts they are much more plentiful than in others. I know many ponds where they exist within a few minutes walk of my house, but do not know of any place literally swarming with them as was a pond near Bristol, which a friend of mine came across by accident, when, of course, he was without net or bottle, and compelled to hurry on owing to urgent business. A find of this kind is really valuable to a microscopist, as each male beetle furnishes eight really interesting slides. I mention the male beetle as producing eight good objects, because his better half only produces six, owing to the absence of the dilations of the tarsi (fig 26) of the front pair of legs, which form, to my mind by far the most interesting portion of this beetle. In Geodephagous beetles the males have a pad on the under surface of this dilation, but the Dytiscus has a most wonderful array of suckers, which, although I have briefly referred to, is worthy of closer attention. One of the suckers is very large, the next about half the size, and the rest like long-stalked champagne glasses. The two large ones seem to be rather like the flower of the common coltsfoot, the centre depressed, and

having radial lines. The small ones are free from the radial markings, and the integument is semi-transparent. On one-half of the pad I have counted 117 of these suckers, so if we double that number for the whole of the pad, we shall have close on 250 suckers, or 500 on both *tarsi.* The female does not possess this piece of apparatus, but has the advantage of size, and has her wing cases grooved from the base to the apex, whereas those of the male are quite smooth. I have before referred to the pugnacious nature of this beetle, ready to wage war at a moment's notice, and not at all particular as to the size of his antagonist. We can with profit take a glance at his means of offence and defence. First of all we find him possessed of a powerful pair of mandibles or jaws, in the use of which he is very dexterous. If you doubt it, go to the nearest pond, catch one and handle him. The tarsi end in a pair of savage-looking claws, which are no doubt formidable weapons, and close by these are the suckers with which to fasten himself to his victim, like the suckers on the arms of the Octopus or cuttle-fish. Each pair of legs terminates in a pair of sharp claws, and underneath the *thorax*, at the setting-on of the large swimming paddles, is a peculiar barbed protuberance, with the points set towards the posterior apex of the beetle, which being forced against the hand cause a pricking sensation. This is almost invariably felt, as the beetle, when captured, always attempts to back out of the hand. Whether he is aware of the use of this weapon, or even if he is aware of the possession of it, I cannot say, as it is a fixture, and only comes into use when he is walking backwards. He possesses another weapon, which is rather more repugnant than dangerous. The Dyticidæ exude a white fluid of a very unpleasant odour when captured. This performance is not peculiar to this family, for we find a family of Geodephagous beetles exuding a black fluid under similar circumstances. The Dytiscus beetle may be kept in an ordinary aquarium, but not in company with fish, newts, or anything of that kind. If you make the mistake of putting him with your pets once, you will not be likely to repeat the experiment. I am informed that fairly large carp are sometimes killed by them.

The first sample of *Dytiscus marginalis* which I remember capturing was clinging to a fish of about the size of the middle finger, which he had evidently killed, and was so intent on his feast, with his mandibles inserted, floating tail uppermost for breathing purposes, that I considered him to be dead, but when I got him and his prize into my little landing net didn't he show fight! Not knowing his nature, and thinking that, being brothers in adversity, the occupants of my collecting bottle would be all right, I popped him in, but soon found that he had made a dreadful havoc amongst the tadpoles, heads and tails being mixed together in dire confusion

at the bottom of the vessel. It will eat almost any insect, and devours raw meat with avidity. Two seasons ago I had a large quantity of newts (the smaller newt and the Triton) in an aquarium. The female newts having deposited their eggs in the curled-up leaves of the water plants. Eventually I had some young newts which were extremely interesting to watch, especially the *branchiæ*, or external gills, but they got less and less, until I had only one remaining, a much treasured prize. The chain of destruction had been going on for some time, proving that a pond must be a lively place from time to time, newts *versus* worms, newts *versus* fish, then newt *versus* newt. As I was watching the little newt one afternoon, a patriarch of the newt tribe gobbled him up in a twinkling. This was too provoking. One aquarium contained only two tyrant newts, and the other a pair of Dytiscus beetles; as they had destroyed everything else, and had acted the tyrant too, I converted one of the tanks into a sort of Inch of Perth, and let them, like Hal of the Wynd, fight each for his own hand. During the first day, the contending parties kept aloof from each other. If the beetles were at the surface, the newts generally were at the bottom, and *vice versa;* but the truce did not last long, for one of the beetles by swimming strongly to the surface at an angle of 45° caught one of the newts by the throat, got it immediately on its back where it seemed quite powerless. In less than a minute the beetle released his hold, and the newt sank to the bottom quite dead; the beetle having in that short space of time drained it of its life-blood. The wound inflicted on the throat, as shown by a post-mortem made on the spot, was circular, and about the size of a No. 4 pellet. The beetle having proved himself easily victorious and being rather tiresome to keep, I put the pair into a phial and added a few drops of chloroform, having quite satisfied myself by the experiments alluded to, that a well-stocked pond must be to the inhabitants at least rather too lively to be pleasant, and after all the suitable insects are devoured. Unless the inhabitants can get out and betake themselves to pastures new like our friend the Dytiscus, they must do as the New Zealanders did before them. They are said to have eaten every specimen of the Dinornis, and then they set to work and ate up each other—so undoubtedly do the occupants of our ponds. Now that I have given you ample proof that Mr. Dytiscus is, for his size, a terrible tyrant, it will be refreshing to hear that even he has to succumb to one who is his master thoroughly: this is none other than "his missus." She no doubt exercises her gentle sway and draws him with cords of love; but if he is not amenable to this treatment and it does not answer, she settles the difficulty by giving him what in sporting parlance might justly be termed an "awful milling," not unfrequently leaving him dead on the battle field. A friend who

kept two Dytiscus beetles for some time, informs me that the female easily killed the male while he was watching them. This sort of occurrence is not uncommon amongst the denizens of our ponds, for often if a worm be dropped between two newts, both make a grab at it, and owing to its wriggling miss it, and catching each other by the foot they fight like bull dogs.

We may now take a glance at the internal economy of this beetle, contenting ourselves, however, with a view of his digestive system, which will furnish you with plenty of work before you have made out all the structures.

At A (fig. 27) may be seen the œsophagus; at the end of which

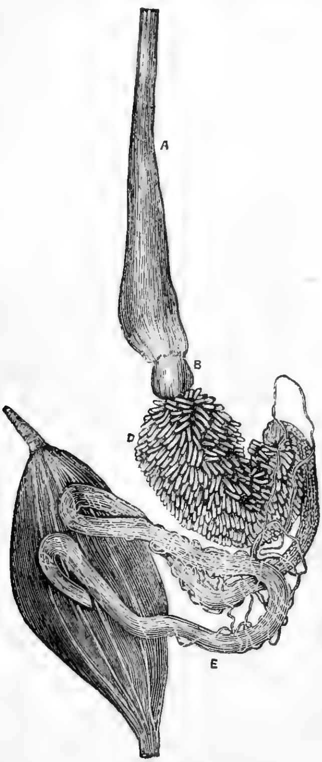


Fig. 27.

Fig. 28.

follows the gizzard B. The food, when triturated here, is passed into the stomach D, from whence it travels through the small intestine E, into the large oval-shaped sac on the left of the figure, which is the large intestine.

The stomach is the principal organ of digestion, and the food is there mixed with the gastric juice. This liquid is always acid while digestion is going on, and possesses the same qualities as that of higher animals, reducing the aliments into pulp, and finally into chyme. The gastric juice is most abundant in those insects which live on animal food. The glands which supply this juice are very well developed, and may be recognised as tiny blunt projections upon the outside of the stomach.

Having described the full grown male and female beetles, I must say a few words about the progeny of this amiable couple. (Fig 28.) I am afraid that I cannot say much in his favour for beauty, but there he is, and you must pass your own opinion. The ladies may say that he is positively ugly. If so, I bow to their decision. I am afraid that I cannot say much in his favour in any other way. I have given you the character of his parents, and he certainly is a chip off the old block. As soon as he is hatched from the egg, the chief business of his life is eating. His colour, as you see, is almost like that of the muddy bottom of the pond where he resides, but the colour adapts itself to the water which he inhabits. If he happens to be located in running water, his colour is lighter than if he dwells in dark stagnant water; for there he finds a dark sombre hue more to his purpose. He lies on the muddy bottom ready to seize anything which comes in his way, and having seized it, he proceeds to make a meal of it without leaving his hold. He is a regular little crocodile. Now there is one point to which I wish to call your attention, and that is to the long sharp mandibles, which are more apparent in the larva than in the full grown beetle. These mandibles are similar in structure to the poison fangs of a serpent, very sharp and having a hair-like tube from the point to the base. When he has seized his victim, he keeps his jaws imbedded, and sucks up the nutritious juices with as much gusto as a City Alderman of the olden time did his turtle soup. He soon gets fat, and changes his coat as before described. After he has done this two or three times, he prepares for the change into the pupal state. He makes a hole in the bank, forms a sort of cell, and then changes into a pupa. The pupal condition varies with the season. If it is summer when he betakes himself to the pupal form, he emerges as a beetle in a fortnight. But if it is at the fall of the year when he retires, the pupal condition lasts till the following spring. After the fully developed beetle emerges, its coat is of a lighter colour, and requires a few days for the armour to become hard; and after this is accomplished, we find the owner ready to try a fall with anything that comes in his way. I have selected this insect for the lecture to-night, to show what perfection of mechanism there is about an obscure creature like a beetle, and what a fund of information may be gained by observing insects

which are within easy reach, and how, by collecting a few specimens of pond life (say on the Saturday excursions connected with the Society), the pleasure may be prolonged for an indefinite time, by setting up a small aquarium and observing the habits of its occupants.

RAMBLES IN THE GREEN FIELDS IN WHIT-WEEK.

IT has generally been my custom to get away from Manchester in Whit-week, and thus escape the unpleasant excitement of the period, and leave behind me the noisy cry of "Correct card of the races," in which I took not the slightest interest, and all the other hub-bub of the week. This last Whit-week certain engagements compelled me to remain near Manchester, so I resolved to utilise what time I could spare to field rambles in search of leaf fungi.

I began by an early trip to the meadows near Urmston, with a general look-out, but with no special fungus in view. For a long time my labours were fruitless, and I had prepared my mind to return home without a single specimen of the plants I was looking for. At this moment my attention was directed to the fruit-stalks of the Common Sorrel, *Rumex acetosa*, when I noticed the blackness of one of them, and it occured to me that it might contain the Ustilago, which is a black smut sometimes found upon the anthers or flowers of the plant. On examination, I was pleased to find I was correct, and the more so because I had never previously been able to meet with this fungus. This lucky find induced me to turn my attention for a time to this particular plant only, and at the end of my day's labour I returned home with four specimens. In the meadows there were thousands of sorrel, but I could not find more than that small number infected with the smut.

I believe the proper name of the fungus is *Ustilago antherarum*. Dr. Cooke does not name the sorrel smut, but refers to others growing under similar conditions.

On a subsequent day (Tuesday) I had a ramble in the fields near to Northenden in company with a friend who, not having a scientific taste, had little interest in my pursuits. Notwithstanding this difficulty, I every now and then stole a few moments to tumble down upon my knees and examine the vegetation around me.

In one of these brief stolen moments I was lucky enough to find a rare and interesting fungus on grass, which I have only met with once before, and then in very small quantity. It was the

Ustilago longissima Tulasne. It was on the bank of the river. After I had succeeded in securing a few blades of grass, thus infected, I found the patience of my friend becoming exhausted, I had to rise up and leave, very reluctantly, the interesting spot.

On the Wednesday, I had an opportunity of devoting a few hours to another ramble in the fields. This time I went alone near the river Mersey, south of Didsbury, and in a comparatively short time I gathered a considerable quantity of the beautiful *Uromyces intrusa*, Lev. This interesting leaf fungus may be found every summer in moderate quantity in the same locality. The plant upon which it grows is the well-known Lady's Mantle, *Alchemilla vulgaris*, Linn. The fungus is of a bright orange colour, on the under side of the leaf of the plant, and is easily found.

On the following day, Thursday, I resolved to devote the time to the bank where I had met with the *Ustilago longissima*, so I set out alone pretty early for Northenden. I had a pleasant walk there, and soon found myself recumbent on the bank, fully at work, and with the exception of the time devoted to necessary refreshment and travel, I spent the entire day on this bank, moving from place to place included in extent to about a hundred yards, and the result of this labour was about fifty or sixty blades of grass infected by the coveted parasite.* When it is remembered that every blade of grass had to be examined as I moved along, it will be easy to understand the small space I covered during the labour of the day; at any rate, I came home quite satisfied with the result of my labour.

As I found, on Friday morning, I should have another opportunity of being at Urmston, I resolved to try again to meet with the Sorrel smut. The occasion which took me there was a private pic-nic in the meadows. From time to time I had opportunities of getting away from my friends and poring over the plants, and I succeeded in finding three more specimens of the Sorrel ustilago.

I have been induced to prepare these notes of field rambles in order to show my junior brother scientific students what may be done if there be a will. It is not enough to walk on and take a general view of the plants as you go, but there must be a personal careful examination, and then you will not go unrewarded.

THOMAS BRITTAIN.

* The *Ustilago longissima* ruptures the cuticle of the grass in longitudinal lines, and has somewhat the appearance of ink-strokes that have been made by a ruler.

The Sorrel ustilago attacks the fertile organs, and ultimately fills up the calyx with a mass of spores, blackening the stalks and other tissues.—T.B.

NOTES ON THE PREPARATION AND STAINING OF WOOD SECTIONS.

By M. H. Stiles, Pharmaceutical Chemist.

THE following notes on the above subject are abstracted from a paper read before the Doncaster Microscopical Society, April 20th, 1881.

Stems of all kinds should, if possible, be cut when fresh. If they cannot be obtained in this state, they may, previous to cutting, be soaked in cold or tepid water, or in a mixture of equal volumes of spirit of wine, glycerine, and water (as I have recommended in a previous paper on the subject).* Fresh stems or roots can be preserved in this medium for almost any length of time, and will remain in excellent condition for the section machine. In cutting sections I make use of an arrangement (devised five or six years ago) by which the blade of the razor is kept from contact with the glass plate of the machine by two small screw clamps which I term razor guards. (Fig 29.) These slide on the blade, one being fixed

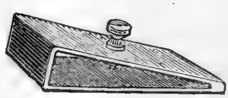


Fig 29.

at each end, and are kept in position by a small screw at the upper side of each. The clamps are about three-eighths of an inch wide, and are made of sheet brass one-twenty-fourth of an inch thick. They ensure a smoother and more steady motion than when the whole of the blade is in contact with the plate, and the edge of the razor is preserved in much better condition, as it touches nothing but the substance to be cut. These guards were made for me by Mr. Hy. Crouch. Sections require bleaching before being stained. The bleaching solution, "made by mixing one-fourth oz. of chloride of lime with a pint of water, shaking occasionally for an hour, and, after allowing the sediment to subside, decanting the clear solution." The process of bleaching should be carefully watched and stopped when complete. Tissues vary so much in colour and density that no fixed time can be given for bleaching them. Very thorough washing is necessary. "The elimination of the chlorine

* Monthly Microscopical Journal, March, 1876.

will be much facilitated by placing the sections, after removal from the bleaching liquid, in a solution of hyposulphite of soda (1 drachm to 4 oz. of water) for an hour," then washing the sections by soaking them for at least six or eight hours in water, changing occasionally, and finishing with distilled water. If they are not to be stained at once, they should be preserved in water containing twenty per cent. of alcohol. If kept in water only, I find that in the course of two or three days they become covered with a peculiar fungoid growth. At this stage all air bubbles should be removed from the tissue. This is conveniently done by placing the sections in dilute alcohol, putting them under the receiver of an air-pump, and exhausting the latter, repeating the pumping occasionally as long as air bubbles are given off. For this purpose I employ a small tube bottle, about $1\frac{1}{2}$ inches long, and a receiver just large enough to hold it, the process is thus rendered a rapid one.

Where it is required to uniformly stain the section in order to render prominent the more delicate cell walls, logwood answers exceedingly well and is very permanent.

LOGWOOD SOLUTION.

Take of Logwood in coarse powder..................	2 oz.
Distilled Water................................	10 oz.

Boil for half an hour in a glass beaker, replacing what is lost by evaporation; strain, and to each ounce of liquid, when cold, add sixty grains of alum and one drachm of alcohol, rub well together, filter through paper, and preserve in a stoppered bottle.

STAINING PROCESS.—Make a filtering cone by twice folding a piece of filtering paper about $1\frac{1}{2}$ inches diameter; support this in the neck of a small beaker or tube, and filter through it about ten drops of the above liquid, add thirty drops of distilled water, place the sections in the mixture for five (more or less) minutes, pour off the stain, wash once or twice in distilled water, then soak for half-an-hour in a solution of alum (twenty grains to the ounce), remove this, wash well with distilled water, and preserve in alcohol so as to be ready for mounting.

The logwood solution prepared in this way gives more satisfactory results than when made as usually recommended from extract of logwood, the latter being a very variable article. Of double stains the most satisfactory are carmine and green and picro-carmine. The former method has been fully described in "Science Gossip" for January, 1880, and in recent numbers of this Journal.

Picro-carmine is the most truly selective of any double stain I have yet employed. A special modification of it is required for wood sections as follows:—

PICRO-CARMINE SOLUTION.

Take of Carmine (finest)........................ 2 grains.
Liquid Ammonia (sp. gr. .960) .... $\frac{1}{2}$ drachm.
Distilled Water to .... 1 oz.

Put the carmine in a two-ounce stoppered bottle, pour in the liquid ammonia, and shake occasionally until dissolved, then add the water;

Take of Picric Acid................................ 8 grains.
Alcohol....................................... 1 oz.

Dissolve in a test-tube with a gentle heat, then mix with the solution of carmine.

STAINING PROCESS.—Place the sections in fifty per cent. alcohol for one hour, then treat with the recently filtered staining solution until the desired effect is produced (usually from half to two or three hours), remove the dye, wash quickly three or four times with alcohol 50°/₀, then soak in an alcoholic solution of picrate of ammonia, changing this after the expiration of an hour, and allowing the sections to remain in the second solution for about the same period.

Details of the process of mounting are given in the paper previously alluded to (M. M. Journal, March, 1876). The logwood stained sections, after being well washed, are soaked in alcohol for an hour, then removed to oil of cajeput, and allowed to remain in this for a couple of hours; at the end of this time transfer the sections to oil of turpentine. In less than an hour they will be ready for mounting in balsam or dammar. The sections should not be allowed to remain long in the turpentine or else they become brittle.

In the case of picro-carmine stained sections they should be removed from the alcoholic solution of picrate of ammonia into alcohol for about a minute, then into oil of cajeput.

The object of employing an alcoholic solution of picrate of ammonia is to avoid the loss of colour which attends the use of alcohol only, the yellow stain of picric acid being readily removed from the tissue by that liquid. Picrate of ammonia may be easily made by adding a slight excess of liquid ammonia to a solution of picric acid, and evaporating the mixture to dryness at a gentle heat. The residue is dissolved in alcohol and filtered.

Wood sections stained in picro-carmine are very beautiful and permanent. The staining being done at *one* operation, and the colours being remarkably selective, there is an absence of secondary tints, as in the case of most other double stains, especially where one tint is partially washed out to make way for another.

Regarding permanence, I have some stained sections mounted nearly five years ago, which appear to me to have retained their brilliancy unimpaired.

In place of alcohol, methylated spirit may be used if desired.

OUR BOOK SHELF.

A Manual of the Infusoria. W. SAVILLE KENT, F.L.S., F.Z.S., F.R.M.S. London: David Bogue. 1880. Part IV., pp. 433-575, with 8 plates.

The fourth part of this admirable work ends the first volume and commences the second. As an appendix to the first, our author takes up the gauntlet which Dr. Cooke threw down, and recapitulates much of what he has stated in the April number of the "Popular Science Review." He has experimented with the Myxogaster discovered in Cheshire by Mr. Thos. Brittain, formerly called *Badhamia capsulifer*, by Dr. Cooke, but now *Physarum tussilaginis* (see THE NORTHERN MICROSCOPIST, p. 142) and has watched the development of its spores. For all the details we must refer our readers to the original paper, which will be found of a most interesting character, and the question is one of such vital importance and interest, that there should be no difficulty in securing workers in this field.

Chapter VIII. contains a systematic description of the Infusoria-ciliata, and here also we find descriptions of the many organisms which are too often overlooked on account of their frequent recurrence. The genus Paramæcium is well described, and all the observations of the different species may easily be followed by the student. The same may be said of such genera as Coleps, Bursaria, Nassula, and others.

The pages treating on *Asthmatos ciliaris* will probably be read with interest by the medical practitioner, who, not thoroughly wedded to the pollen theory of the cause of "Hay Fever," will find some food for reflection on pp. 466 and 467 and future study. The character of the work is well maintained through these four parts, there is scarcely a page which does not contain matter of more than common interest.

Angular Aperture of Microscope Objectives. GEO. E. BLACKHAM, M.D., F.R.M.S. New York: The Industrial Publishing Co. 1880. 21 pp. and 18 plates.

This is a reprint in book form of a paper read before the Microscopical Congress at Indianapolis, on the 13th of August, 1878. In his preface the author makes apology for the omission of mathematical formula, stating that such would either be uninteresting or unintelligible to a large number of microscope users, who are nevertheless desirous of information upon the subject of Angular Aperture.

In the above we readily concur, and though we would have seen the matter demonstrated with a little more grace than the author has inspired into his work, yet we must admit that the treatise is one which may enable students to get a firmer grasp of "Angular Apertures" than they have had the chance of getting before. Even an unbiassed reader would have great difficulty in believing that the treatise was not one long tirade against Mr. Wenham, but the valuable information contained in it more than counterbalances this fault. Of course there is some excuse for this, if we remember the Aperture controversy which was carried on some years ago in the "Monthly Microscopical Journal;" still there are two methods of demonstrating a scientific fact, and we regret that men of science often take the wrong one.

By far the most valuable portion of the paper commences at page 13, in which the question is discussed, "How should angle of aperture be measured?" The author then proceeds to show (working with a student's ¼ inch by Tolles) how this operation may be performed, repeating the process with a duplex sixth by the same maker, having a balsam angle of 95°. Seeing that Professor Abbe has published quite recently a paper bearing upon the subject of Apertures,* it is well to call our readers' attention to it: the subject should be thoroughly understood by the student, and all we desire is to call attention to trustworthy works which stimulate progress.

NORTHERN SOCIETIES.

BOLTON MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER NATURAL SCIENCE ASSOCIATION. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER CRYPTOGAMIC SOCIETY. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER SCIENCE ASSOCIATION. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. NORTH OF ENGLAND MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

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* Journal of the Royal Microscopical Society, April, 1881.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. No Microscopical Society in existence.

NOTICES OF MEETINGS.

BOLTON MICROSCOPICAL SOCIETY.—Although this Society enjoys a Summer holiday during the months of June, July, and August, the work is not entirely suspended, for the valuable collection of Slides now in possession of the Society is being re-arranged owing to several recent additions; the most noticeable of which is the gift of six dozen choice Slides by Mrs. Redmayne, from the valuable collection of the late Dr Redmayne, the founder of the Society. In order that the most suitable selection might be made, Mrs. Redmayne kindly placed the whole collection in the hands of the President and the Secretary of the Society for this purpose. Forty eight choice Slides of Diatoms have also been added, so that the members to whom the Slides are lent, will have ample occupation for leisure hours during the winter evenings.

CARLISLE SCIENTIFIC SOCIETY.—The annual meeting of the members of the Carlisle Scientific Society and Field Naturalists' Club was held in the Museum, in this city, on Tuesday evening, May 3rd. Mr. Ferguson, F.S.A., presided, and there was a good attendance, including Mr. Binning, Mr. Maclaren, Dr. Barnes, Mr. Hall, Mr. Baillie, Mr. Cartmell, Dr. Carlyle, Rev. E. H. Ford, Mr. Joseph Hannah, Mr. W. Duckworth, Mr. Dodd, Mr. G. Dawson, Mr. T. Duckworth, and Mr. John Sinclair (secretary).

Two reports were read by the Secretary, one for the Museum and one for the Society. In the former, attention was called to the vast improvement that had been made in the Museum during the year. The expenditure had exceeded the income by £1 3s. 6d., and since the end of the year other amounts had been paid out by the Treasurer (Mr. Binning). From July, 1877, when the Museum was opened, to the end of March, 1881, the sum taken at the door for admission was £221 10s. 6d., or £63 5s. a year. The expenses during the same period had been £86 2s. 11d., which had gone almost entirely in cleaning and attendance. The Committee calculated their legitimate expenses for the future at £45 per annum, which would leave a balance in favour of the Museum of something like £18. This might possibly be further augmented by closing the Museum for three or four months when there was little or nothing to do, and so saving £10 for attendance. The number of visitors since the opening had been 26,671, exclusive of members of the Scientific Society who came in free. The Chairman said the report would not be put for adoption but would be sent to the Corporation. At present they owed the Treasurer £18, but they had managed to pay their way so far, and had incurred a very large outlay in getting cases and additional rooms, which they had almost to re-roof and re-floor. In 1879, their expenditure was £18, and last year it was only 6s. short of £100; therefore they would be able to keep their heads above water. Still they had a rickety building, and they might have to do more than they contemplated to keep it water-tight.

The report of the Society reviewed what had been done during the past year, and the Committee urged members to assist by volunteering papers and otherwise. The Chairman (who is treasurer of the Society) said there had not been a balance sheet since June, 1878, at which time there was a balance of £23 to the good. There were almost no expenses in the next half year, and at the end of 1878 there was a balance of £45 in hand. At midsummer, 1879, that was

reduced to £25, the expenditure including £10 for 200 copies of the *Transactions* of the Association which were delivered free; expenses of lectures, £4; hire of lecture rooms, £6. In the next half year there were no expenses whatever, and the balance increased to £39 13s. 10d. In the half year ending June, 1880, lectures cost about £4; printing, £11; *Transactions*, £9 10s; capitation grant, £4 15s.; and a contribution of £25 towards the expenses of the cases in the Museum. On the 30th June last there was a balance of £7 8s. 2d., which was increased at the end of the year to £18 16s. 3d. The expenses included lectures, £2 15s.; sundries, £2 16s. 6d.; printing, £17 16s. 2d.; lecture room, £5; capitation grant, £3 15s.; *Transactions*, £7 15s.; balance, £2 8s. 11d. All the Society owed was £1 3s., which need not be paid till Christmas, while about 40 members were in arrears with their subscriptions. If they got that in they would be doing very well.

The ordinary business of the Society being completed, a discussion took place as to the advisability of inducing the proposed Microscopical Society to establish themselves as a section of the Scientific Society. Mr. Hall, surgeon, said he had been deputed by the meeting recently held in the County Hall to attend here and explain matters. The only difference of opinion at that meeting was as to how the proposed Society should be conducted. He himself thought it would be best likely to succeed as a separate Society, but others thought success would be best secured if a union with the Scientific Society could be affected. The first difficulty was that the smaller fee of 5s. would not cover the expenses, and the Museum rooms were ill-suited for the microscope. They were not steady enough. Still steady tables could be bought, and if those rooms proved unsuitable another might be got. They were quite prepared to form a Society separately, but if the Scientific Society were prepared to offer facilities and advantages, then it would be for another meeting to entertain the proposal. The Chairman said such a combination would be quite in accordance with the rules and the objects for which this Society was formed. The Committee had discussed it and would do everything they could to facilitate the objects of the Microscopical Society. Dr. Barnes said the Committee had held a meeting to discuss the terms on which such a section of the Society could be established, but only members of the Scientific Society Committee were present. They concluded that it would be desirable that the Microscopical Society should be a section of the Scientific Society, the members of the former to be members of the latter, the section to elect its own officers who would be responsible for the business and have control of the funds, and if the section ceased to exist, its books and other property to become the property of the Museum Committee. He moved the following resolution:—"That this Society views with approval the proposal to form a Microscopical Society in Carlisle in connection with the Scientific Society, and refers to the Committee the power to make the necessary arrangements for the establishment of a Microscopical Section." Mr. Binning seconded the resolution. Mr. Maclaren said matters looked extremely well for a union of the views of both sides, and probably a little modification of the conditions read out by Dr. Barnes would meet all their wishes. The Scientific Society was established on a sufficiently broad basis to take in this section, and they might do worse than devote some of their future surplus to promoting the active study of science. Mr. Sinclair said it would scarcely be wise of the meeting to commit itself to anything. The Chairman said the meeting was not in a position to make any pledge, but he thought the two should be joined. He should like to see the Museum rooms made the centre of scientific effort in Carlisle, with a view to the day when they might have a proper place built with a small chemical laboratory. Next year, or the year after, the annual meeting of the Cumberland Association would be held in Carlisle, and they might make an exhibition of microscopical apparatus a feature of one of the afternoons. When they got rid of the Museum debt they should have money to invest, and one way of spending it would be on a

microscope for members who had not one of their own. The resolution was then put and carried, and a vote of thanks was given to the Chairman.

THE CARLISLE MICROSCOPICAL SOCIETY.—An adjourned meeting of the gentlemen interested in forming a Microscopical Society in Carlisle was held in an ante-room of the County Hall, on Wednesday evening. Mr. Hall, surgeon, presided, and there were present Dr. Maclaren, Dr. Carlyle, Mr. A. B. Moss, the Rev. C. Dowding (Dearham), Mr. Young, Mr. W. Parker, Mr. Slingsby, Mr. T. Duckworth, Mr. W. B. Dodd, Mr. J. Tiffin (Fusehill), and Mr. W. Duckworth. Mr. Moss was appointed Secretary *pro tem.* The Chairman said it seemed to be an understood thing that they should form a section of the Scientific Society, and he handed to the Secretary the conditions on which it was proposed they should be admitted. There would be no practical difficulty, as they would pay 5s. to the Scientific Society and receive corresponding advantages, and the two working together and assisting each other they could hardly fail to be a success. The conditions were then discussed *seriatim.* On the first—that all members of the Microscopical Society shall be members of the Scientific Society—a question was raised whether members living at a distance might not object, and whether they might lose valuable service in that way. It was pointed out, however, that the connection only involved a payment of 5s. a year, and that if the Microscopical were an independent Society the subscriptions would have to be raised by that sum. The condition was accepted, as were also the following others after a few remarks:—(2) That members of the Microscopical Society be elected according to the rules of the section, and on payment of such separate subscription as may be agreed upon; (3) That the section shall elect its own officers, who shall be responsible for the management of the business of the section, and shall have control of the funds; (4) That the Scientific Society and Museum Committee provide the necessary accommodation for the meeting of the section; (5) That in the event of the Microscopical Section ceasing to exist, the books and other property of the section shall become the property of the Museum Committee. Dr. Carlyle expressed his belief that it was not properly understood that members of the Microscopical Section had to pay 5s. to the section and 5s. to the Scientific Society. Dr. Maclaren: Shall we ask the Scientific Society to provide funds? It was pointed out that it would be absurd to suppose that they could get along without any subscriptions of their own. The Chairman expressed his pleasure that they had got themselves established. He hoped that some time the Scientific Institute would be removed from Finkle Street to a better situation. It was agreed that the Chairman, Mr. Moss, and Mr. W. Duckworth present the resolutions to the Scientific Society, and request to be accepted on those terms. A series of rules, based on those of the Quekett Microscopical Society, was read over, but consideration of them was deferred. A vote of thanks was given to the Chairman, and thirteen gentlemen put their names down for membership.

[We were rather surprised at the want of courage displayed by the Carlisle microscopists at their first meeting for the formation of a Microscopical Society in that city. Those who read the above reports, which have been extracted from the Carlisle newspapers, may not be astonished; but from a business point of view, we must say we fail to see what advantages can accrue to microscopists in binding themselves to another Society, which, according to its own report has "a rickety building on which they might have to do more than they contemplated to keep it water-tight;" that out of less than 200 members, 40 were in arrears with their subscription, and of which (according to the Chairman, who is also Treasurer) there has not been a balance sheet since June, 1878. We wish the section every success, and while we should like to know what has made the members take such an extraordinary step, remind them that the Manchester Microscopical Society with a subscription of only five shillings annually,

manages with its 170 members to carry on an independent existence, has the nucleus of a library and cabinet of slides, possesses furniture and apparatus, holds demonstrating and mounting classes, organises sectional rambles for collecting raw material, insects, mosses, ferns, pond life, &c., and is in a remarkably good financial position.—ED.]

DONCASTER MICROSCOPICAL SOCIETY.—The twelfth ordinary meeting of the above society was held on Wednesday evening, the 18th May, the Rev. W. R. Weston (vice-president) in the chair. In the absence of Mr. J. B. Withington, two papers were read on the parasites infecting pork—one by Dr. J. Mitchell Wilson, on *Trichina spiralis;* the other by Mr. W. Walker, on *Cysticercus cellulosæ.* As a large amount of interest throughout this and other countries has recently been manifested in the parasitical diseases affecting pork, which are capable of being communicated to man, the following points, alluded to by Dr. Wilson and Mr. Walker, may be of interest to general readers. The *Trichina spiralis* belongs to the group of round worms, and is most frequently observed enclosed in a cell or cyst, curled up in spiral shape. These cysts, which are found only among the muscles of the meat, are scarcely visible to the naked eye. Under the microscope, the worm in its free state measures in the female one-eighth of an inch in length, and the male only one-eighteenth of an inch. The young in each female has been estimated at from 10,000 to 15,000. Within two or three weeks after obtaining an entrance into the stomach, say from imperfectly cooked pork, these enormous numbers of young trichinæ are born, and at once begin their wanderings. They burrow along the muscular tissues, becoming encysted, and it is during this stage that the violent muscular pains are experienced, which are prominent signs of the disease in man. Dr. Cobbold estimated that in one person, who had eaten a known quantity of pork infected with trichinæ, there would be at least 42,000,000 parasites. Some of the epidemics which have occurred in Germany have caused a mortality of less than 2 per cent. of the persons attacked, while in 1865 an outbreak in one town attacked 350 persons, of whom 100 died. Dr. Wilson had carefully examined eighteen specimens of pork, obtained from shops in different parts of his district, but in none of these were any trichinæ found. Specimens were, however, shown, obtained from a friend at a distance, from a piece of ham infected with the parasites, and other prepared slides exhibited infected muscle both from man and the pig. It is said that a temperature of 160 deg. Fahr. kills the free trichinæ, but the encapsuled worms are able to resist a much greater degree of heat, and are not destroyed by the usual methods of smoking, pickling, or roasting the meat. If the interior of a piece of meat, roasted or boiled, retains much of the blood and colour of uncooked meat, the temperature has not been higher than 130 deg. Fahr. These facts ought to lead us to observe the advice of the medical officers to the Local Government Board, who say that any sample of meat, thought to contain the parasite, ought not on any account to be eaten, no matter how it is cooked, and that the only means of avoiding disease in man from the dangers arising from trichinæ in meat from pigs is by very *thorough and efficient cooking*, which means generally cooking it one half as much again as the ordinary rule. At the conclusion of Dr. Wilson's paper, Mr. William Walker, M.R.C.S., gave a short account of *Cysticercus cellusosæ*, the larval form of the tapeworm, *Tænia solium.* The presence of these parasites constitute that disease in the pig commonly known as the measles. Under the microscope they appear as small egg-shaped bodies lying between the muscular fibres. Although the larvæ are found in other animals besides the pig, the mature tape worm exists only in man. The head of the Cysticercus is of globular form, furnished with four suckers round the margin, and fourteen or more hooklets in the centre. When the egg or germ of the tape worm is swallowed by an animal it is hatched in the stomach, and afterwards forces its way into the various tissues of the body, where, like the trichinæ, it becomes encapsuled, and re-

mains dormant, forming the Cysticercus. When flesh, thus infested, is swallowed by man, the Cysticercus is developed into the fully-formed tape worm. In connection with this parasite, there is the advantage that when present it cannot easily be overlooked, as the meat infected with it has a very characteristic appearance. Should there be any doubt, the discovery of the hooklets under the microscope would at once dispel it. The reading of the papers was followed by an interesting discussion, in which the chairman, the authors, the Rev. W. Smith, and Messrs. Burman, Kirk, Stiles, and Tindall took part.

LIVERPOOL MICROSCOPICAL SOCIETY.—The sixth meeting was held at the Royal Institution, Colquitt Street, on Friday, the 3rd June. The evening was devoted to an exhibition of the circulation of the blood in several different forms of animal life, by the members of the society. The subject was introduced by a short paper on the structure of blood corpuscles, by Frank T. Paul, Esq., F.R.C.S. The paper included a short description of the chief varieties of blood cells met with in the different divisions of the animal kingdom; but the only corpuscles that were minutely described were the red and white blood cells of the higher animals. The structure of the red cells was now universally considered to consist of a porous stroma, which was permeated by the essential element of red blood, called the Zoöid, the character of which was considered, both chemically and microscopically. The white cells were shewn to be of almost equal importance with the red ones, for while the latter are concerned with the nourishment and areation of the tissues, regeneration of injured parts depends entirely upon the former. The manner in which this takes place was described in association with reparative and destructive inflammation. In the latter the white cells of the blood become pus corpuscles, and thus a great discharge of pus has a very deleterious effect upon the constitution of the blood. The paper was illustrated by diagrams and various preparations of blood corpuscles.

At the conclusion of the paper the meeting resolved itself into a conversazione, when the subject was illustrated by the following:—

Specimens illustrating the paper		F. T. Paul, F.R.C.S.
Blood corpuscles of	Cassowary	Thomas C. Riley.
Do.	Frog	E. G. Tooker.
Do.	Salamander	H. C. Beasley.
Circulation of blood in	*Asellus vulgaris*	John Vicars.
Do.	Fishes' tail	Dr. McClelland.
Do.	Fresh-water Shrimp	H. R. Boult.
Do.	Frog's foot	Tapley Bacon.
Do.	Jacksharp	Isaac C. Thompson.
Do.	*Pulex irritans*	Dr. Hicks.
Do.	Tadpole	Rev. W. Banister.
Do.	Do.	G. F. Healey.
Do.	Young Newts	Henry M. Bennett.

MANCHESTER MICROSCOPICAL SOCIETY.—The fourth ordinary meeting of this session was held on Thursday, June 2nd. There was a good attendance, and eight additional members were added to the Society's roll. The business of the meeting was varied, and principally consisted of communications from the following members:—The President, Messrs. Thos. Brittain and Geo. E. Davis, Vice-Presidents; Mr. Herbert Chadwick, Mr. Hyde, Mr. Aylward, and Mr. Cook.

Mr. John Boyd, the President, in his communication on *Leptodora hyalina*, stated that when he announced last autumn that he had found *L. hyalina* in Lake Derwentwater, he said that he fully anticipated that if other lakes were properly examined it would also be found in them. Recently he had an opportunity of verifying this assertion, as in May last, while spending a short time at

Trefriew, N. W., he dredged a little lake lying amongst the hills, above the village. At first he was unsuccessful, but making another cast in the rapids, where the stream runs out of the lake, and where the current was tremendous in consequence of the late heavy rains, what was his surprise and delight when he took up the net to find three or four fine specimens of *Leptodora*. They were swimming about with their peculiar jerky motion in the bottle attached. This he said strengthened his opinion that as the creature had been found in many Italian lakes it also would be found in many of our British lakes, if properly hunted; still it does require the greatest care, and good and practised eyesight to detect it even in a bottle in spite of its considerable size.

Mr. George E. Davis, F.R.M.S., followed with a description of the Micro-spectroscope (Browning's) as preparatory to his exhibiting the absorption bands in Nitrate of Didymium, roseine, eosine, cochineal, indigo, pansy, and litmus. They were very successfully shewn, and interested a great number of the members present.

Mr. Herbert C. Chadwick gave his promised communication on the heart of the Fairy Shrimp *(Chirocephalus diaphanus)*. He said it was an animal consisting of 14 segments, or with the head 15. The heart is situated anteriorly, and lies between the dorsal surface and the intestine. It is a tubular organ, its anterior extremity occupying the hinder portion of the head, the posterior extremity being situated about the middle of the sixth segment. Corresponding in position with the second, third, and fourth segments are three pairs of valves. These are oval in form, and are so disposed as to allow the blood to pass in only one direction, viz., from the cavity which surrounds the heart into the heart itself. A single medium valve is situated at the posterior extremity of the organ which prevents the passage of blood backwards into the heart. At the junction of the eighth and ninth segments this vessel divides into two branches, and these branches cannot be traced farther than the middle of the tenth segment. Blood corpuscles freely flow along the lower branch but only one was observed to flow along the upper. The anterior extremity of the organ is very much obscured by a mass of muscular fibre, so that it could not be ascertained whether there is a valve or not. The number of pulsations (which are very irregular) are at the rate of 200 and over per minute. Mr. Chadwick, in conclusion, remarked that in his observations he had the misfortune to crush a specimen, and all the intestinal organs, except the heart, were crushed out, but he was much interested to see that the short and rapid pulsating movements were replaced by a movement similar to the peristaltic contraction, so characteristic of the intestines of vertebrate animals.

Mr. Henry Hyde, in speaking of the starches of wild plants, illustrated his remarks by several slides, showing the starch cells of oxalis, arum, &c. Mr. R. Mestayer and Mr. Thomas Lofthouse further illustrated this subject by exhibiting sections of potato and carrot. Some discussion followed on the best methods of mounting starch granules. Mr. E. Ward said that carbolized water was a good preservative. Mr. George E. Davis thought that slides of starch granules should be put up in two ways—in carbolized water for ordinary observation, and in damar for observation with the polariscope, while specimens of the different starches are best kept dry in the homœopathic medicine tubes.

Mr. Cook then exhibited specimens of the Boterill Trough and Life Slide (see June No. of the NORTHERN MICROSCOPIST).

Mr. Aylward, of Cotham Street, Strangeways, exhibited a simple yet ingeniously constructed form of self-centering mounting table. It is well-finished and revolves smoothly, and answers very well the purpose for which it was designed.

Mr. Thos. Brittain, with the assistance of Mr. Cook the honorary secretary, distributed to all the members present specimens of a Cluster-cup he had recently met with in Ireland, on the sea coast of Bangor, Co. Down. This fungus is known as *Æcidium ranunculacearum*, and was in unusually fine con-

dition. Mr. Brittain referred to the notes he had recently written respecting various local micro-fungi for the NORTHERN MICROSCOPIST, and said he was glad to have heard that some of the members had successfully made use of the information he had given. To those who had not been successful he said he should be glad to supply them with specimens from his own gatherings if they would call upon him.

During the evening the circulation of the blood in the Tadpole was shewn by Mr. A. Doherty, and several tadpoles were distributed by him amongst the members. Mr. J. Robinson brought with him a fine catch of Hydra, and these were liberally supplied to all who wished for specimens.

Mr. H. C. Chadwick exhibited the eggs and young of Water Boatman, and capsules on *Dytiscus marginalis*. Mr. Daniel Alston shewed specimens of *Chirocephalus diaphanus*. Mr. Hy. F. Jenkins *Fredericella sultana* and *Cordylophora lacustris*, and Mr. Lofthouse a capitally prepared specimen of the gizzard of the Cockroach.

THE MANCHESTER SCIENCE ASSOCIATION.—The fourth meeting of this Society was held in the Memorial Hall, Albert Square, on Tuesday, June 14th, Mr. E. Ward in the chair.

After the minutes of the previous meeting had been read and confirmed, Mr. Tozer (Treasurer) read a deeply interesting paper, entitled "The Blow Fly" *(Musca vomitoria)*. After describing the family, class and order to which this well known object belongs, he proceeded to give the external anatomy and uses to which the different organs are put by this fly. The head, he said, is composed of five segments, three of which form the proboscis, two belong to the head proper, the fifth connecting it with the thorax. There are two sets of eyes, the compound and the simple. The first are large, and contain 4000 to 5000 facets, which are hexagonal; and owing to the great convexity, and the fact that no two facets can see exactly the same object at the same time, it is very doubtful if the fly can see any objects placed near these eyes. The simple eyes are three in number, and are placed on the upper part of forehead, and form a triangle; they have great refractory power and convexity of form, and are thereby adapted to see objects very near to them. The antennæ he believed to be organs of touch and smell combined. The proboscis is protected by a sheath, within which it moves, and is composed of three parts or joints—at the end of which it forms two fleshy lobes, or oval shaped suckers. Fluids do not pass between the lobes in the same way as solids, but through the spiral tubes which open from the innerside through a very small entrance, the fluid then passes along these spiral channels which empty themselves in the centre of the lobes and from thence into the mouth. The thorax is composed of three rings, each of which support a pair of legs. The legs consist of five parts, the *coxa*, *trochanter femur*, *tibia*, and *tarsus;* the last also consists of five parts, and has two appendages in the shape of claws. Beneath the claws are two pads, the *pulvilli;* the claws and pads are connected by a single muscle which projects into the tarsal joint, and runs direct through the thighs into the thorax. No part of the fly's anatomy has given rise to more discussion than the pad. It is covered with hairs which are tubular, with trumpet-shaped ends, and which terminate in the shape of a disc. Mr. Lowne says 'there are about 1200 hairs on each pad, each of which secretes a glutinous fluid, never becoming hard till the foot is removed, and that when the foot was removed obliquely there was little or no resistance; now exactly the same action would take place if the hairs were held by the pressure of the atmosphere acting upon them when a partial vacuum was formed within the tube of the hair.' The reader's opinion is that the foot is fixed by 2400 hairs, held by a vacuum, assisted by a moist (not gummy) fluid given off from the tubes when pressed. The muscular arrangement of the wings is very complicated, and terminates in the cavity of the back; at the base they are thickened, and are so connected that they form a powerful fulcrum, by which

the wings are raised or depressed, just above the large muscles of the wing. It is so formed that when going with the wind, the air passes through an inverted cone-like curl in the wing at that point, acting like the sail to a ship. When it wants to go across the wind, the *poisers* come into play, and act as a balancing pole. The spiracles form two distinct sets, those on the segments of the body are the expirating valves, and those between the legs the inspirating valves. The shape and arrangement of the hairs is extremely interesting. They are so arranged that they offer the least resistance to the atmosphere; they are keel-shaped, being flat at the back, and a fine edge at the front: at the base or root of each hair is a bulb, forming a single cell; from this bulb runs a number of fibres forming the hair. On the surface of the skin the hair passes through a highly polished horny ring; it thus forms a true ball and socket joint. The portion of the hair which is likely to come in contact with the ring is smaller in diameter. When flying against the wind, the hairs lie down, and the point of one comes between the two hairs above it like tiles on a roof. On going with the wind, these hairs are elevated, and act like miniature sails. Like every other organism it is subject to parasites, of which there are three—two animal and one vegetable.

After a slight discussion, the meeting resolved itself into a conversazione, at which Mr. Tozer exhibited Slides mounted by Topping, and by himself exhibiting the different structures to which he had referred.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.—This society held the first of a series of rambles in search of animal and vegetable micro-organisms, on Thursday afternoon, June 2nd. There was a very fair muster. The Rochdale members met the Whitworth contingent at Broadley station at 2-30. The ramble was conducted by Dr. J. Shackleton of Whitworth. Turning into the fields to the left of Broadley station, the party proceeded through Smallshaw via Weaste to Prickshaw, thence via Spring Mill Waterworks to Doctor's Wood. Here some good finds of Diatoms and Desmids were made. A few botanical specimens, rarely to be met with in this district, were also found, among which were *Pinguicula vulgaris*, *Polygala vulgaris*, two varieties, *Lathyrus macrorhizus*, No. 1 variety, *Callitriche verua*, *Sagina procumbens*, *Viola palustris*.

After a ramble of four hours, the members adjourned to the house of Dr. Welsh of Whitworth, where the usual monthly meeting of the society was held. Dr. Welsh presided. The general business of the society having been transacted, the meeting resolved itself into a conversazione, when the following subjects were put under the microscopes for examination:—

Closterium Cosmarium Spirogyra Pinnularia Navicula	..........Results of finds.
Euglena viridis—green	..........Mr. J. Astin.
Fredericella sultana Chara and Nitella *Euglena viridis*—brown Fresh Water Algæ	..........Mr. Bolton.
Golden Fern *Isthmia nervosa* Coscinodiscus Section of Human Tooth	..........Mr. I. Renshaw.

THE WINDSOR AND ETON SCIENTIFIC SOCIETY.—The inaugural meeting of the Windsor and Eton Scientific Society, which has just

been formed in connection with the Albert Institute, was held on Tuesday evening, May 17th, numbers about 80 members, and appears to promise a very flourishing career. The Rev. W. Gilbert Edwards, who has been elected the first President, presided, and there were also present Rev. A. Applegath, Rev. E. Hale, Rev. E. Tahourdin, Rev. J. H. Crowder, Dr. E. Norris, Messrs. J. W. Gooch, E. Pearl, P. H. Carpenter, Bullock, Lundy, W. H. Harris, Dyson, Fountain, Russell, &c.

The President delivered an address in which occurred the following passages:—Many members of this society intend to study nature with the aid of the microscope—and let me here say that the society is already beginning to be rich; for through the liberality of Mr. Holderness we possess a microscope of our own, and one which the committee hope to place in this museum at the disposal of those members who have not one for their use in investigating specimens. It is only by means of the microscope that the earliest germs of disease can be known and much evil may be averted; much good brought about by the minute examination of fibres which would baffle search by the keenest eye—adulteration in food, fraud in the making up of fabrics, can sometimes only be detected by the aid of this instrument; so that social and commercial interests are well served by a cultivation of its use. By way of commencement, it is proposed in the first place to hold a general meeting in this room on the second Wednesday in every month, to which members may bring a friend. We hope to arrange for the introduction of the subject of the evening by a paper, which will be followed by a general discussion, by the exhibition of objects illustrating the subject, and by a complete investigation of it by explanation in the more minute details. The next general meeting will be held, if all's well, on Wednesday, June 8th, here, at 8 p.m., and our enthusiastic Secretary, Mr. Gooch, has kindly undertaken to read a paper on a well-selected subject, "The Structure of a Plant." It is hoped that we shall be able to have some sectional meetings or classes, in which the elements of the several branches may be learnt; and the Secretary would be glad to receive the names of those who would be willing to give a short course on any subject, and also of those who are desirous of beginning any particular section, such as botany, geology, or the microscope. The committee have already redeemed their pledge of forming a library. I have great pleasure in laying the foundation of this means of instruction by giving the volumes already published of "Science for All," and I do this the more gladly as there is no fear of the books straying, for our good friend Mr. Applegath has presented us with a stamping machine containing the title of the society for impression on our books and papers. The following books are already in hand: "Town Geology," "Hogg on the Microscope," "Science for All," "Carpenter on the Microscope," "Bentham's Brit. Flora," "Oliver's Botany," Miss Buckley's "Fairy Land of Science," ditto, "Life and her Children," and three magazines—"Science Gossip," "Nature," and "Journal of the Microscopical Society,"—will be taken in for the benefit of the members, under regulations put forward by the committee, who will make arrangements for the use of the society's microscope. During the course of the summer we look forward to some pleasant excursions into the neighbouring country, and hope to explore the riches which such places as Burnham Beeches, the Riverside, the Forest, have in store for diligent searchers, and to bring back treasures which shall fill our museum, where there is plenty of room at present for specimens good of their kind well preserved; and it may be that we shall be able to compare notes with societies who have tastes in keeping with our own, and give and receive help from each other in our investigations and pursuits.

Mr. P. H. Carpenter then delivered a lecture on "Pond Life," stating his belief that an oral address would be more interesting than a written paper. He first noticed the Amœba, or Proteus animalcule, remarking that Professor Huxley said not long ago that there were some who did not know whether to class it as an animal or a plant. It was very difficult to watch them through their

various stages, and it was only in a very few cases that this could be satisfactorily done, as it took a long time to watch them through their life cycle; and he mentioned that certain enthusiastic investigators had taken turns of six hours each at the microscope to watch the birth, life, and death of this minute animal, and that was the only way of getting perfect knowledge of it. It was just observable with the naked eye. It was continually changing its shape. It had no stomach, no mouth, and in fact "no nothing." It took in food through an opening in its surface, which closed up immediately after. There was an oval or round substance in it which was somewhat firmer than the rest, and that was called the nucleus. There was a little space near the edge which, if watched, would be found to disappear and reappear with great regularity, and this was supposed to perform the functions similar to the heart in other animals. There was a great deal of fascination in watching this animal, which was one of the simplest forms of life.

He next described the Hydra, or freshwater polype. It resembled the Amœba in having a nucleus, which was of horseshoe shape, and a contractile vesicle. He described this animal in detail, and also the Vorticella, or bell animalcule; the Stentor, or trumpet animalcule; and the Rotifer, or wheel animalcule.

The Chairman proposed a vote of thanks to Mr. Carpenter for his address.

The Rev. E. Hale, in seconding the proposition, suggested that anyone working with a microscope should, if he found anything worthy of notice, bring it to the next meeting, and should make notes of time and circumstances under which they were seen. This would help others to know where certain things could be found, and help further discovery.

LETTER TO THE EDITOR.

Microscopic Flora and Fauna.

SIR,—If I may be granted a few lines in your extremely interesting journal, I would like to call the attention of your readers, more especially of the Secretaries of Societies, to the vast amount of good which must accrue to the whole generation of microscopists by the publishing of lists of objects to be found in various localities.

This may be done in several ways; but I conceive there is no better plan than by following the style in which the ramble of the Manchester Microscopical Society is reported on page 119 of the May number—there are no superfluous words; all is to the point, and tells exactly what is required: first, the direction in which the ramblers went, and second, the game they bagged.

There is another way of accomplishing the same end, and that is by means of notes such as that on pond-life, on page 123, signed R. G., and on the previous page by Mr. Thos. Brittain. If every district into which THE NORTHERN MICROSCOPIST goes was written up in this manner, the journal would be of the greatest assistance to the student.

I am, &c. H. H.

NOTES AND QUERIES.

In my enumeration of leaf fungi which may be found in any month, I desire the student to bear in mind that these mysterious parasites do not confine themselves to one month only. Some will appear during several months of the spring or summer, and others have a shorter existence. It is not improbable that in various parts of the country the plants I have occasion to refer to, may not be found at the time I mention (as found by myself), but I prefer to refer to these specially as a guide to my brother students of this northern district. If any should fail in finding the fungi to which I refer as growing in certain localities I shall be glad to give more exact information on the subject if they will see me personally, as I have a strong wish that this very interesting branch of microscopic study should receive more attention than it has hitherto done. Amongst the rusts that may now be found are several which deserve attention, amongst them is one common on grass; it is known as *Trichobasis rubigo-vera* or *T. linearis*, and may be met with during the entire summer until autumn fairly sets in. The red rust appears on the grass leaves in broken lines, hence the name *linearis.* So there is no difficulty in knowing this fungus at first sight. I have met with it near Urmston, near Prestbury, and in numerous other localities. *Trichobasis violorum* on the violet is to be found during this and following month. It is a minute black smut on the leaves of the plant. I have never found it in quantity nearer than Wales. A third may be found about this time in Miller's Dale, Taxal valley, and nearly all over this district, on the Compositæ, it is known as *T. cichoracearum.* It is also a black smut. Many others of this genus are to be met with about this time. Amongst the Æcidiacei to be found, there is a very common one on garden mint; it grows chiefly on the stalks near the roots, and has more the appearance of a Trichobasis than a cluster cup, it is called *Æcidium menthæ.* I have found it also upon the wild mint *Menthæ sylvestris* on two or three occasions in the Buxton valley. The one on garden mint I have found in gardens in Greenheys, Manchester, close to the city, yearly, until the spot was built over with houses. Besides the Æcidiacei I have hitherto named, many others may now be met with, but I fear not near Manchester. The one on the leaves of the primrose, I have only met with in Devonshire; the one on garlic, *Æcidium alii*, I have only met with once, when I found it on the banks of Lake Windermere. The Bladder-campion cluster cup may now be found near the sea-side about this time; I have frequently met with it, and it is one of the most beautiful of the Æcidiacei. Besides the fungi which infest the *Anemone*

nemorosa already mentioned, there is a white cluster cup. *Æ. leucospermum*, one of the most beautiful, but not often found in this district; I have often met with it in the Lake District and once in Wales. There are two rusts, as they are commonly called, which may now be found upon the leaves of the willow, *Lecythea saliceti* and *L. mixta.* The willows about Northenden and other marshy districts are annually infested with these rusts, and are easily found. A very beautiful one, *L. Valerianæ* on *V. officinales*, is more rare; I have but once found it, and that was in a wood near Taddington, in Derbyshire. From this time during the summer, an interesting white fungus may be found upon the Shepherd's Purse *(Capsella bursa-pastoris.)* It is *Cystopus candidus*, and the same fungus may be found also upon cabbage and other Cruciferæ. The former of these is very common, but the latter is more rare; I have only met with it twice, once at Deganway, near Conway, and the other on the north coast of Devonshire. Another Cystopus *C. cubicus* is pretty common on the goat's beard. *Puccinia saxifragarum* should have been mentioned in last month's notice, but it may still be found in favourable situations. It is known as the Moschatel brand, and is found on both surfaces of the leaves of *Adoxa moschatellina.* Numerous other micro-fungi are now to be found in almost every field or upon every hedgebank. Grasses, leaves of trees, and plants of all kinds are liable to be infested, so that the student who earnestly seeks for interesting objects of this kind will very rarely return from a ramble in the country unrewarded.—*Thos. Britain.*

Lepisma Saccharina.—This active little insect, the scales of which were at one time in great request as test objects, is often found upon the shelves of cupboards, in window cracks, between books, and many other places in the household. It is shown magnified in fig. 31.

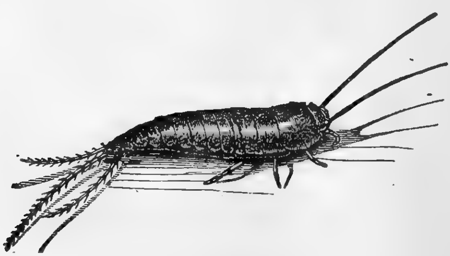


Fig. 31.

The body is elongated and flattened, the antennæ setaceous, with numerous very short joints; four palpi, the abdomen terminated by three long jointed filaments.

THE CATERPILLARS AT CLITHEROE.—Considerable commotion has been occasioned in Clitheroe and the surrounding district during the past month, owing to circulation of the intelligence that a huge quantity of insects of peculiar construction had arrived in the neighbourhood, and had located themselves in the vicinity of Pendle Hill. The phenomenon was first observed at the beginning of the month by persons passing along the road over Pendle Hill, leading from Sabden to Clitheroe. What appeared to onlookers as caterpillars were noticed to be crawling along the road in large numbers, and each succeeding day they increased until the road was almost black with them, and it was impossible to place the foot on the ground without crushing several of them. Day by day they progressed in their mysterious journey, until at length they arrived at the Wellsprings beerhouse. The proclamation of the news of this visit induced a large number of naturalists from all parts to visit Clitheroe *en route* for Pendle, and the result has been that they have carried back with them large quantities of the insects, and caused them to be inspected in a great many towns. The insect has had bestowed upon it a great variety of names. A local naturalist is of opinion that those of Pendle Hill are the perfect specimens of the caterpillar *Plusia gamma*, or the silver Y, so called from the silver mark on the wings in the shape of the letter Y. A correspondent writes to tell us that the caterpillar is that of the antler or grass moth, *Charæas graminis*, which often does much damage in Germany, France, and Sweden. Another correspondent is sending us several, so that we may be able to say something more next month.

PHOTO-MICROGRAPHS.—We have received during the month two very good photographic enlargements of the Liver fluke *(Fasciola hepatica)* and of the parasite of the Whale *(Prenogonium litorale)*, from Mr. W. Shipperbottom of Bolton. They are two of several taken to illustrate Mr. C. L. Jackson's paper on "Parasites and Messmates," notice of which has already appeared on p. 136 of THE NORTHERN MICROSCOPIST.

UTILIZATION OF MICRO PHOTOGRAPHS.—During the siege of Paris by the German forces microscopic photography played an important part. By its aid the besieged were enabled to send information to the outer world. Printed information was reduced by means of photography to a minute scale. These Microscopic despatches were conveyed by means of Carrier Pigeons and other devices, to various towns in France.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

R. C. P.—Thanks for the cuttings. The caterpillars arrived too late for notice this month.

W. S.—The photographs arrived safely, and are very well displayed. You will see we have alluded to them. Thanks for the information.

M. H. S.—The photographs and apparatus shall be carefully returned to you.

C. J., B. A., H. C.—See our reply to D. B. and others, in last month's issue.

W. B.—Thanks for your tube of organisms; the larger ones, however, arrived dead.

We are obliged to those numerous correspondents who have replied to our queries in last number, and assure them that their remarks will be fairly considered.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

PHOTO-MICROGRAPHS of Liver fluke from sheep and parasite from whale in exchange for well-mounted slides of desmids, algæ, lichens, parasites, &c. W. Shipperbottom, 8, Chatham-street, Bolton.

CATERPILLARS from Pendle Hill. I shall have pleasure in sending (on receipt of stamped directed box) to any of your subscribers, two or three of the caterpillars. R. C. Pilling, Robin's Nest, Blackburn.

SLIDES FOR EXCHANGE.—"Beta," care of Editor.

HYDRA FUSCA for tube of H. fusca. Send botanical object of interest. —Midgley, 244, Waterloo-st., Bolton.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

Collins's histological microscope, new, ½in. and ⅛in. objectives, polariscope, micrometer, coarse and fine adjustments, mirror, two eye pieces, cabinet. Cost over £10; price £6 10s. cash. Geo. Postlethwaite, 1, Newbarns, Barrow-in-Furness.

MICROSCOPE FOR SALE.—A good No. 3 binocular, by Browning, with ½ inch and ¼ inch objectives, by the same maker, and a pair of A eyepieces. Also achromatic condenser polariscope, camera lucida, Morris' stage, Selenite stage, and silvered side reflector, the whole in mahogany case, with box for apparatus, cost £26. What offers for this splendid working instrument?—Address, in first instance to CHEMICUS, care of the Editor, NORTHERN MICROSCOPIST.

OBJECTIVE.—A fifteenth, by Dancer, 170° angular aperature, price £8. This is a splendid glass, the only reason for parting with it being that the owner is about purchasing a homogeneous sixteenth, and does not want both. A splendid glass for working at Bacteria. —X., care of the Editor.

THE NORTHERN MICROSCOPIST.

No. 8. *AUGUST.* 1881.

THE MICROSCOPICAL TURNTABLE.

THE turntable is perhaps the most important instrument in the hands of the preparer and mounter of objects. Originally devised by Mr. Shadbolt as a simple brass circular plate about three inches in diameter, upon the surface of which was placed a pair of springs for the purpose of holding down the glass slip, it has been the parent of several forms which have been supposed to be of benefit to the microscopist. In order that the slides may be easily centred, the table is usually engraved with a series of circles; but it is readily seen that such centering can only be approximate.

In 1870, Dr. Matthews devised a turntable to accurately centre slides in the direction of their width, and which possessed the further advantage that no springs or other portions of the table rose above the slide, to catch the fingers or brush, during its revolutions; and in the next year Mr. J. B. Spencer, in a communication to Science Gossip, showed how this might be made in hard wood by the microscopist himself.

In order to centre the slides accurately in one direction, that of width, Zentmayer introduced the simple device of fixing a couple of pins equidistant from the centre and at opposite sides of the table, the slide being so arranged that it touched both of these pins. This centres for the width, and in length this is accomplished by a series of circles near the edge of the table, the operator making the adjustment from inspection of these.

In Science Gossip for 1874, Mr. Bridgman described and illustrated a form of turntable which, though not self-centering, enabled a slide to be always placed in the same position upon it, so far as the centre of rotation went. In 1875, Mr. C. F. Cox of New York, devised a self-centering turntable, which consisted of the circular revolving plate, in which was cut a slot in the direction of its diameter, and in which were moved, by means of a right-handed and left-handed screw, a pair of clips which gripped the opposite and extreme corners of the slip. It will thus be seen that so long

as the edges of the slip are at right angles to each other the centering must be absolutely accurate, but not otherwise.

On the introduction of this machine several operators objected to the method of holding the slip, and Kinné soon afterwards introduced his modification, in which the two corner clips were drawn together and made to grip the glass slip by means of an indiarubber band or spiral spring.

In 1876, a notice appeared that Mr. Charles Butterworth, of Shaw, near Oldham, exhibited at the annual soiree of the Oldham Microscopical Society a turntable capable of making cells of either circular or elliptical form; and also by its aid a thin cover glass could be held in position on a cell, whilst the various rings of cement or varnish were put on.

In 1879, Mr. Rolfe re-invented Kinné's turntable, and described it before the members of the Quekett Club, adding at the same time an idea of his own, which was quite novel.

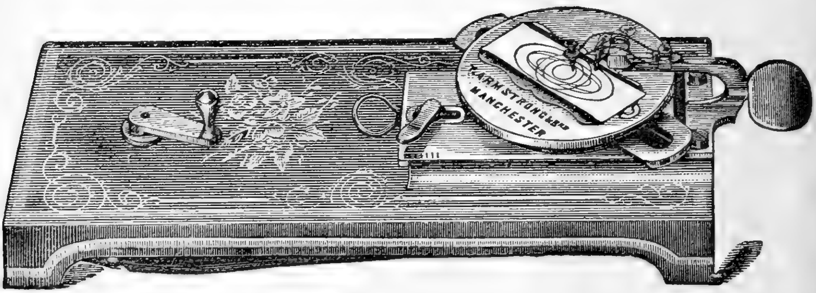


Fig. 32.

The year 1880 saw the introduction of two turntables, the first by Mr. Dunning, which has since been made by Mr. Swift, and the second introduced by Dr. Matthews. Mr. Dunning's turntable will take any slides up to two inches in width, and will also serve for retouching slides the circles upon which are not truly central. Dr. Matthews's last production is to be found fully described in Vol. III., page 717, of the *Journal of the Royal Microscopical Society*, its object being different to any we have previously considered. The improvement consists (or is said to consist) in means for setting the table in motion, and is so arranged that by pulling down a cord a rotary motion is imparted to a pulley, which acts upon the table when moving in one direction only. After pulling the cord to its full extent a spring carries it back again, turning round the pulley and pawl in the reverse direction, when it is ready for a second forward movement, the weight and momentum of the table being sufficient to maintain its forward motion during the reverse action of the pulley and pawl.

This is only another way of doing what Mr. Martin tells us in 1872, "My own turntable is worked by clockwork machinery which gives greater rest to the hand,"—and which we think totally unnecessary, as even those who prepare for the trade do not generally use any machinery for driving the turntable.

The turntable of which an illustration is given in fig. 32 is made by Messrs. T. Armstrong and Brother, of Deansgate, Manchester, and is entirely different from any other form yet made for the public. It is constructed upon the principle of the "oval chuck," and so enables either circles or ovals to be traced with ease—moreover, it may also be used for cutting thin glass covers, either oval or circular, as well as for general mounting purposes.

Another good form of self-centering turntable has lately been introduced by Mr. H. P. Aylward, of Strangeways, Manchester, which we hope to describe in our next.

MOTION OF DIATOMS.

By J. D. Cox.

THE investigation of the motion of diatoms is occupying the attention of observers in Europe, and a Russian naturalist has recently published some experiments made with infusions of coloring matter which were conducted in a similar way to those made some years ago by Prof. H. L. Smith with indigo. Prof. Smith noticed that particles of indigo in suspension in the water were moved along the raphe of the living diatom, sometimes collecting in a ball at the central nodule, and, again, running along to the end of the frustule, were broken and scattered in a rather symmetrical cloud about the extremity of the shell. The later observer has not noted the formation of a ball, or the motion along the raphe, but has reported the cloud-like aggregation of particles, and drawn from the phenomena he witnessed, the conclusion that the cause of motion of the diatom is the exosmose and endosmose of fluid.

Before any satisfactory solution of the problem can be reached, or any decisive determination whether the motion be due to osmotic or to ciliary action, a good deal of patient observation must be made,—both of the motion itself under varying circumstances, and of the structure of the diatom, including the nature of the raphe itself and the question of the existence of a gelatinous envelope covering free as well as stipitate frustules.

The following observations, which have recently been repeated

and fully verified, are copied from notes made in the Summer of 1879, and are a contribution to the record of facts which any sound theory on the subject must account for. They certainly seem most consistent with a supposition of ciliary action, though it is possible that some form of osmotic action might produce similar phenomena.

A fresh gathering of diatoms from a little brook near Cincinnati, contained a number of *Nitzschia linearis*, which had progressed so far in self-division that the front view of the frustule was twice as broad as the side view, but from the peculiar form of the *Nitzschia* the carina was in plain view on each edge of the frustule as it lay or moved on its broader side. The first case I noticed was that of a frustule apparently held fast by the glasses of the compressor, but a gelatinous mass of decomposed vegetable matter was seen moving steadily along the frustules from one end to the other, making a momentary halt in the middle. The mass was as large in diameter as the width of the diatom, so that it reached from side to side of the frustule, overlapping the carina of the valve on one side. The motion of the loose matter was once or twice reversed, as if the diatom was trying to back out of its position, and so produced a current in the opposite direction. Presently the diatom got loose, backed out and moved a considerable distance across the field, the gelatinous substance still adhering and being dragged after it. Again an obstruction was met, the diatom stopped, and as if the machine were reversed in the new effort to back out, the foreign matter was again dragged to the foremost end, and this time a smaller floating particle of similar kind moved in the same manner along the opposite valve of the frustule. In an effort to make the diatom roll over, so as to enable me to make more sure of its species, it was swept out of sight and lost.

A little later some fresh samples of similar materials afforded a repetition of the phenomena and a confirmation of the facts. A frustule of the same species as the former was so wedged in the compressor that one end was free, whilst the other was fast. The free end would move vigorously one way or the other, in an arc of a circle, but the diatom was not released. Attached to it were two gelatinous masses, one on each side, and of similar size to those described in the former case. These were distinctly applied to the valves so that, as the diatom lay in front view, as before, the two masses were on the opposite sides of the frustule. These masses moved along the sides, sometimes the whole length of the diatom, sometimes only to the middle, where they would rest a while, and then either complete the motion or go back. They did not always move simultaneously, nor with the same speed, but with a general agreement of motion. The action was continued half an hour, the diatom not getting free.

Turning to another part of the slide, I found another free moving specimen with a similar gelatinous mass in contact with it. The diatom was moving freely, and towing the mass along with it, attached to its hinder end. Soon the mass began to move forward on the shell, the motion of the diatom ceased and was presently reversed, the order of sequence being distinctly as stated. In several instances the motion of the gelatinous mass from the rear end of the diatom forward, plainly preceded the change in the direction of the frustule, as is the change of ciliary motion (assuming that to be the motive power, for the sake of illustration,) did not instantly stay the diatom, but required an appreciable moment of time to overcome the momentum. My observation of this shell continued for a full hour, the changes of direction being frequent, and all the accidental modifications and phases of the phenomena were strikingly confirmatory of the existence of some force applied along the line of the raphe, acting sometimes in one direction and sometimes in another, in such a way as would be fully explained by supposing ciliary action along that line, but which do not seem to be so easily accounted for by osmotic action, certainly not by osmotic action at the ends of the frustule.

On one or two occasions the acting force did not appear to be reversed at the same instant at the two ends of the diatom. Twice the foreign matter moved against the current of general motion, slowly, it is true, but really in such a way as to indicate that the force acting upon it was not in the same line of direction as was that exerted on the other half of the frustule. But when the motion controlling the gelatinous mass became vigorous, it either became dominant or was indicative of harmonious action at both ends of the shell, so that the motion of the diatom through the water became very pronounced and strong.

I looked for similar phenomena among the other kinds of diatoms in the gathering, but saw nothing of the sort except in the instances described. The Naviculæ were very lively, but I saw no examples of action upon foreign matter that came in their way. Neither could I detect any current, even along the Nitzschias; the motion of the gelatinous substance occurring only when it came in contact with the shell and apparently sticking to it.

My study of the diatom-shell has led me to accept the opinion that the raphe is a real fissure in the shell, but in many species it is not a simple and vertical linear-opening of the shell. It is more like the joint formed by the overlapping of the edges of curved tiling on a roof: a thickened line of silica borders one lateral half of the shell, while the other half dips under it with a thin film. It is true that an osmotic force may be conceived as working along the raphe, as well as that a line of cilia should do so; but the difficulty is to account for such action upon an extraneous mass as that

which I have described, or to make osmosis from such a place upon the shell move the diatom in the direction of its length. The assumed presence or absence of a gelatinous film enveloping the diatom does not materially vary the conditions of the problem in either case. If we assume that the osmotic action is at the extremities of the shell, the observed phenomena, as to the action upon the gelatinous mass when in the middle of the frustule, are unaccounted for.

As to the manner in which the lapping of the halves of the frustule along the raphe is effected, it may be most easily seen in some of the coarser Pleurosigmas. In broken shells of *P. attenuatum* and *P. formosum* I have seen it very plainly demonstrated. Sometimes the thickened line of silex, which borders one-half of the frustule, will be found sticking out alone, the thinner part of the shell being broken away from it. Sometimes it will be in its normal position, but the lateral halves of the shell will be separated by pressure so as to show on one side the thick edge, and on the other the fitting gutter caused by the projection of a thin lip. Occasionally also a cross fracture of the shell will be found on a broken fragment, in such position that we get the benefit of a cross-section, and see the whole joint in the form I have described. —*American Monthly Microscopical Journal.*

LEAF FUNGI IN AUGUST.

THE Microscopist who takes an interest in leaf fungi will find August especially favourable for his purpose, for a large number of the most interesting of such parasites now begin to make their appearance, while others, to which I refer, placed in favourable situations, may have made their appearance even earlier. Amongst them are the Erysiphe, a section of the Perisporiacei. *Erysiphe Linkii*, the Mugwort blight (on *Artemisia vulgaris*) may be found in great plenty in this month. I have often met with it on the river bank near Cheadle Bridge; in the neighbourhood of Northenden; near Southport, and elsewhere. The appendages surrounding the fungus and the sporangia with its two spores are very interesting features of the plant.

Erysiphe Martii. Pea blight is common on many plants besides peas; it is also on beans, on Umbellifera of various species, and other plants. This fungus is very abundant in autumn, especially after a wet period. The sporangia and appendages differ from *E. Linkii*, and will soon be known by comparison.

Erysiphe graminis. Grass blight is not so common as the above,

but will be found by the industrious student who has frequent opportunities of getting into the fields in autumn. The leaves of the common buttercup are subject to one of these parasites, but as far as my own experience goes, I should be inclined to say it is rare; I have but seldom found it.

Towards the end of the month, nearly every burdock *(Arctium Lappa*, Linn) that can be met with is covered with thousands of the *Erysiphe Montagnei.* Abundance of the plants, all infested with the parasite, may be found in almost any part of Cheshire or Derbyshire, and elsewhere, during the autumn up to the end of October.

The Dogwood *(Cornus sanguinea)* is subject to the fungus, *Erysiphe tortilis.* This is a very minute fungus, requiring a good eye or a magnifying glass to recognise it. I have met with it but once when in Monsall Dale some ten years ago.

Now may be met with another section of leaf fungi which belongs to the Pucciniæi. I allude to the Phragmidium. The leaves of the Bramble, the leaves of the lesser Burnet *(Poterium sanguisorba)*, the leaves of the wild strawberry, as also of the raspberry and rose leaves are all liable under certain conditions to be infested with the brand. In all cases the beginning of the perfect fungus is indicated by an orange or bright yellow rust on the under side of the leaf. This is called Uredo by some writers and Lecythea by others, and was formerly believed to be a distinct fungus ; it is now, however, known to be but an early condition of what ultimately becomes the perfect fungus. I have occasionally met with some of these early in July, and from thence through the autumn up to October. Last October I found a large quantity on the Bramble *(Phragmidium bulbosum)* and on the wild raspberry, *P. gracile* in the Lake district. I have not found any Phragmidium near Manchester, the nearest point is Chelford where, some ten years ago, I met with *P. bulbosum* in very fine condition. North Wales is good hunting ground for these parasites. There I have met with them in great plenty.

On the larger burnet *(Sanguisorba officinalis)*, there is a most interesting fungus now appearing under favourable conditions ; this is the "Burnet chain brand" *Xenodochus carbonarius* of Schl. It has somewhat the appearance of a necklace or string of black beads, and is most interesting as a microscopic object. On the leaf of the plant it is preceded by bright orange-vermilion spores, *Uredo miniata*, and frequently the spores and the perfect fruit may be found on the same leaf. I have found this brand year after year in the Buxton valley, about two miles from Buxton. It may be found also in the Bollin valley, near Bramhall, and elsewhere. I once had the good fortune to find a minute species in a wood near Taddington, in Derbyshire, Dr. Cooke has named it

Xenodochus curtus, and I have been given to understand that since its discovery by myself in 1873 it has not been found by any other person. It is described on p. 201 of Dr. Cooke's "Rust, Smut, Mildew, and Mould."

A complete host of Pucciniæi may now be found within a short distance of Manchester, amongst them the thistle brand. *Puccinia syngenesiarum.* This is indicated by a yellowish tinge of the infected leaf. The yellow spores are known as *Uredo cirsii.*

The grass Puccinia, *P. graminis*, may be found now on corn stalks or leaves of wheat or grass. Common garden mint is now very liable to be infested with a Puccinia, *P. menthæ.* It is very common and easily found. There are many others which I have never found near Manchester, some very interesting. Amongst them *P. betonicæ* on Betony I have often found in the Lake district and at other distant points, some fifty to a hundred miles away. Also *P. variabilis*, which I have often met with far away from home on the dandelion. Pignut brand, *P. umbelliferarum*, I have found at Taxal and in various parts of the Bollin valley, as also near Wilmslow and elsewhere. It has just occurred to me that the Ragwort brand, *P. glomerata*, is very common near Manchester, I have found it in Hough End Clough, near Cheadle, and elsewhere, and in large quantity at Rusholme, on the very spot where the Manchester Carriage Company have lately erected their stables.

The Ustilagos may be found now pretty generally; some will have appeared before this time, but nearly all of them may be expected to be found during the month.

The *U. carbo* on corn and grass is pretty plentiful—too much so for the farmer; as is also the bunt of wheat, *Tilletia caries.* Some of the Ustilagos I have met with as early as June, but they generally linger on until autumn.

I refrain as a rule from referring to leaf fungi I have not personally found, as I desire my notes to be a guide to the microscopic student. Doubtless there are many other leaf fungi to be found near to Manchester during the month which I have not named, but it is time I brought my paper to a close.

THOMAS BRITTAIN.

A RADIAL SUBSTAGE ILLUMINATOR.

THE swinging substages of Messrs. Ross and Beck are useful for obtaining very oblique rays of light with the help of the condenser. This has been accomplished in another way by Messrs. Swift and Son, in their Radial Traversing Substage Illuminator.

While regretting that this firm could not have found a shorter title for this accessory, we must say it seems a useful method of producing obliquity of light. It is shown in Fig. 33.

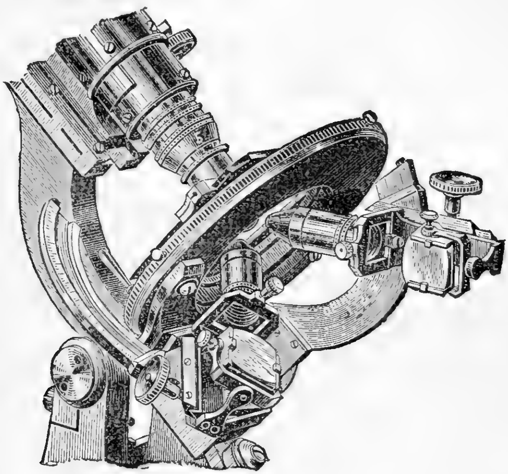


Fig. 33.

This apparatus has been constructed for the purpose of increasing the resolving property of high power objectives by causing still more oblique pencils to impinge upon the object than can be obtained by most methods. The arrangement consists first of an arc-piece, fixed below the stage, radial to an imaginary line drawn through the axis of the microscope objective, in the same plane with the object. On this an achromatic condenser of special construction is made to travel, thus keeping the rays of light on the object during its entire traversing. These rays converge and terminate in a focus through the front lens, in a highly concentrated form. The condenser is illuminated by a rectangular prism, for condensing light into the achromatic combination. The next part consists of a second arc-piece placed at right angles to the former one; this also carries a similar achromatic condenser and illuminating prism, which move radial to the centre. Both these arc-pieces are so divided that each pencil of light can be projected at a similar angle, and previous results can always be recorded in the same way. Difficult test objects are readily resolved, especially such diatoms as have rectangular striæ or markings. With a $\frac{1}{4}$-inch objective, the diatom *Navicula rhomboides* is easily resolved into squares. The markings on *P. angulatum* by the same means is

made to stand out in bold relief like half spheres. Those usually considered easily resolvable only require one pencil of light to show the markings. When this is the case, the rectangular arc-piece with all its illuminating apparatus can be turned away from the microscope stage as shown in Fig. 34. The same illustration

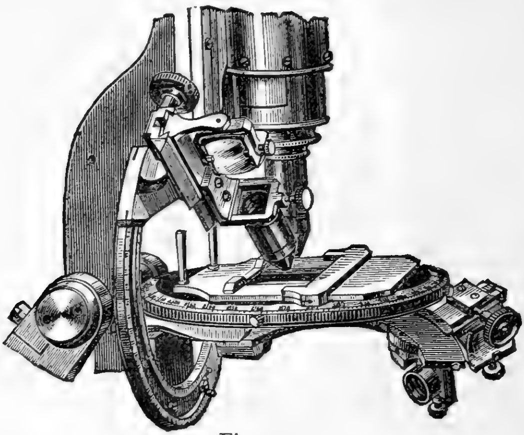


Fig. 34.

shows how opaque objects may be illuminated, viz., by moving the condenser of the first arc-piece above the stage of the microscope, when a pencil of light can be projected on to the object more perpendicularly than with the bull's eye condenser, thus preventing shadows in coarse or deep objects which often produce distortion and false appearances. When the apparatus is used for opaque objects with a lower power than the 1-inch objective, the achromatic combination can be removed and the light directed from the prism, which can be made to give convergent rays sufficient for use with a 4-inch objective.

HOW TO PROCURE AND MOUNT RAPHIDES.

By S. A. Webb.

As a handsome slide of raphides is always attractive, I give the following process for obtaining and mounting them :—

The hanging plant known as "Spider-wort" *(Tradescantia)* contains myriads of these needles. Place a slide upon the turntable, cut off the vine or stem of the plant transversely (somewhat

obliquely), and you will find the juice of the plant forming a half drop on the cut end. Set the table in motion without delay, and place the drop on the cut end, upon the centre of the slide slowly, moving it outward as the table turns, so that it shall not twice pass over the same spot, until you have formed a scroll-like circle with the juice, of about a quarter of an inch in diameter. Let the slide remain fifteen or twenty minutes, place a drop of fresh balsam upon the centre, and place upon it a half-inch cover-glass. Let the cover sink down slowly until it is in contact with the balsam, throughout. If not level, press it gently, so that the balsam shall fill out handsomely. Set it away, but do not heat it. It will require some time to harden, but if in haste to use it, as soon as the balsam at the edge of the cover has hardened somewhat, run a circle of a solution of shellac in alcohol, so as to touch both the edge of the cover and the slide. This will hold all fast, even though the balsam be still liquid within. Finish this if you choose, at once, and your slide is done. Examine the slide by oblique (black ground) light, or far better, if you have it, by polarized light. Use the green, not the purplish coloured, "spider-wort," and you will find the needles beautifully distributed, clean, and looking like polished steel. The needles are oxalate of lime, and are beautiful with polarized light.—*American Monthly Microscopical Journal.*

OUR BOOK SHELF.

A Synopsis of the Fresh-water Rhizopods. ROMYN HITCHCOCK, F.R.M.S. New York: 51, Maiden Lane. Pp. 56.

That elaborate work, "The Fresh-water Rhizopods of North America," compiled by Professor Joseph Leidy, and published by the United States Government, not being within the reach of every one, we welcome this little treatise which the author believes will in most cases enable the student to name the specimens that he has collected without the aid of figures, This is so: the orders, sub-orders, and genera are all accurately and minutely described, still the student must have made considerable progress ere descriptions only render him infallible in his nominations.

The following description of the Genus Amœba will show how this has been performed:—

GENUS I.—AMŒBA.

"When at rest, a spherical or oval mass of soft, hyaline, colorless, granular protoplasm. When in motion, form variable. Ectosarc hyaline and minutely granular, endosarc continuous with the former,

finely and coarsely granular, with corpuscles of varied character, ingesta of food, etc. Nuclei, and one or more pulsating vacuoles. Pseudopodia digitate, simple or branched."

Then follow minute descriptions of *A. proteus*, *A. verrucosa*, *A. radiosa*, and *A. villosa*, with the measurements of each.

Several pages are devoted to the general character of the Rhizopods, their food supply, and where they may be found. Their measurements are also given in micro-millimetres, which the author terms micras; a *micra* being the thousandth part of a millimetre, is designated by the Greek μ, and is equal to $\frac{1}{2540}$ of the English inch.

The author tells us that Fresh-water Rhizopods are far more common in the ordinary collections of the microscopist than is generally supposed, but since they are seldom looked for they are often passed by unnoticed. He also tells us that in systematic collections the superficial ooze at the bottom of still water should be examined, after it has been allowed to settle for some time in a suitable vessel. Rhizopods are common in the slime of submerged rocks, stems, and leaves, especially so in moist Sphagnum; they are to be found almost everywhere in moist situations not too much shaded, among decaying logs, mosses, lichens, and on the bark of trees.

We hope by drawing attention to this little work (which may be obtained from the author at the address already mentioned, for three shillings and postage) that we have obtained some students for the Rhizopods; they are exceedingly interesting though too often neglected.

Portfolio of Drawings and Descriptions of Living Organisms which have been sent out by THOMAS BOLTON, F.R.M.S. London: David Bogue. No. 5, 17 Drawings.

This Portfolio, issued in June, 1881, contains illustrations and descriptions of—

VEGETABLE KINGDOM.

Protococcus pluvialis	Batrachospermum.
Vaucheria	moniliforme.
Fresh Water Algæ.	

ANIMAL KINGDOM.

Ophrydium longipes.	Pterodina clypeata.
Stentor polymorphus.	Gammarus pulex.
Trichodina pediculus.	Caprella lobata.
Clava squamata.	Alcyonidium polyoum.
Syncoryne frutescens.	Bowerbankia imbricata.
Anguillula glutinis.	Triticella pedicellata.

Pedicellina cernua.

NORTHERN SOCIETIES.

BOLTON Microscopical Society. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER Natural Science Association. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER Microscopical Society. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL Microscopical Society. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER Microscopical Society. Hon: Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER Cryptogamic Society. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER Science Association. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. North of England Microscopical Society. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM Literary and Philosophical Society. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM Microscopical Society. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH Microscopical Society. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. No Microscopical Society in existence.

NOTICES OF MEETINGS.

MANCHESTER CRYPTOGAMIC SOCIETY.—The usual monthly meeting of the Society was held at the Old Town Hall, Monday, June 20th. Capt. Cunliffe, V.P., presided in the absence of Dr. Carrington, who was absent through physical indisposition. Mr. W. H. Pearson exhibited several rare hepatics. *Gymnomitrium crassifolium*, found by Mr. West on Ben Nevis; *Jungermannia saxicola*, from Glyder Vawr, found by himself; and an abundance of fruiting specimens of *Nardia alpina*, collected by himself and Mr. Stubler on Bowfell this month. According to Dr. Gottsche this species has not hitherto been found in perfect fruit.

Mr. Cunliffe exhibited specimens of that critical and rare moss *Gymnostomum squarrosum*, which it is interesting to note as having been found near his home at Handforth, and also fine specimens of *Pleuridium alternifolium* from Styal, *Zygodon conoideus* from Barmouth was also amongst the mosses exhibited by Mr. Cunliffe.

Mr. Cush gave a description of a recent excursion to Wharfedale, and described the finding of such rarities as *Encalypta streptocarpa* in fruit, and an abundance of *Tetraphis pellucida* and *Orthodontium gracile* in the same condition.

The rest of the evening was spent in examining a splendid collection of mosses which had been collected by Dr. Schimper, and which was lately presented to the Free Library by the executors of the late John Windsor. The members were delighted with the fine specimens of rare species which the collection con-

tains, and expressed their gratitude for the thoughtful generosity of the donors of the same to our Manchester Free Reference Library.

MANCHESTER MICROSCOPICAL SOCIETY.—The ordinary monthly meeting was held in the Lecture Hall of the Mechanics' Institution, on Thursday, July 7th. The President, Mr. John Boyd, in the chair.

Mr. C. L. Cook, the honorary secretary, brought before the notice of the members a new form of microscope, made by Messrs. Armstrong Brothers of this city. The stand is specially designed for steadiness, and is well made. The application of the diaphragms for the admission of light is novel; the body is furnished with a graduated draw-tube, and two good object glasses of one and a-half inches and one-sixth of an inch focus are supplied. There are two eye-pieces and a bull's-eye condenser on stand. The whole is packed in a mahogany case, and forms a capital portable instrument for the working microscopist.

Dr. Tatham notified to the members the publication of a new edition of Carpenter's work. He confessed he was sadly disappointed when going through the book to see so little improvement on the last edition.

Mr. John B. Pettigrew read a paper on the Gnat and Mosquito. The paper was well illustrated by coloured diagrams and prepared slides. An abstract of this paper will appear in our next.

Mr. Thos. Brittain followed with a description of a Day's Ramble in Derbyshire. This paper was especially interesting to microscopists, as specimens of the objects named had been gathered, prepared, and mounted by the reader. These were much appreciated by the members present. Mr. Brittain said it would be well if the members reported to the society from time to time the results of their rambles. He intended to do so as a guide to their younger students, that they might, through the medium of THE NORTHERN MICROSCOPIST, know where to go and what to look for. My ramble on the present occasion, he continued, began at Miller's Dale, on my arrival there from Manchester by a Midland train, about half-past ten o'clock a.m. On leaving the valley I took the old road along which the telegraph poles are carried, direct to Tideswell, pronounced Tidzy by the natives. On ascending the hill I frequently turned round to look back upon the charming Miller's Dale I was leaving behind me. From the top of the hill onwards to Tideswell, about three miles, is a wild open country, not very interesting. Tideswell is noted for its remarkable fine old church, which contains some interesting old monuments. The town contains about 2,000 inhabitants, and in the days of hand-loom weaving was a prosperous place. At present it wears the appearance of decay. All along the way I had been looking right and left at the botany of the district, but with not very satisfactory results. Betwixt Miller's Dale and Tideswell I had not met with that common but very beautiful cluster cup on the coltsfoot known as *Æcidium compositarum* var. *tussilaginis*. On the old walls at Tidswell I found the interesting little fern *Ruta muraria* wall rue. On the high hills betwixt Abney and Hathersage I was delighted to find an excellent specimen of the nettle cluster-cup *Æcidium urticæ*. I have only found it once before in Derbyshire, when I found it in a wood near Haddon Hall. I tried hard to find other specimens of the nettle cluster-cup but in vain. The coltsfoot one was in great plenty all around me and in fine condition. As I approached Hathersage I met with an excellent crop of the beautiful *Uromyces intrusa* on the lady's mantle, *Alchemilla vulgaris*. After describing the Hope Valley—one of the most beautiful in England—Mr. Brittain said that at Hathersage he found a premature development of the thistle rust. The early fruit of this fungus is in the form of Uredo spores, *Uredo cirsii*, the perfect fruit being *Puccinia syngenesiarum*. This fungus is to be found very plentifully, and in better condition later on in the season. Concluding, Mr. Brittain said that if any of his hearers cared to follow his example and enter Derbyshire over Abney Moor to Hope Dale, they

will have a treat not soon to be forgotten. The road is not known to tourists generally, but after this short record of his ramble it may be better known, and, he hoped, frequently taken advantage of.

After the discussion the meeting resolved itself into a conversazione, when the following objects were exhibited :—

Male Mosquito, and oral appendages of the female gnat ...	The President.
Female of Common Gnat, larva and head of do.	Mr. J. B. Pettigrew.
Crystals of Formate of Copper (Pseudomorphous)............	Mr. E. Ward.
Hydra Vulgaris, stained with picro carmine, and mounted as a permanent object......................................	Mr. E. Ward.
Pond Life : *Fredericella sultana* and *Hydra Viridis*...... ..	Mr. Robinson,
Larva, pupa, and imago of the Bacon Beetle..................	Mr. Dunkerley.
Infusoria in Sea Water...	Mr. Alston.
Various slides, illustrating Lepidoptera.........................	Mr. A. Doherty.
Sectious of Spines of Echinus..............................	Mr. Herbert C. Chadwick.

Mr. H. P. Aylward had on view a copy of a rare work, entitled the *Micrographia*, by G. R. Hooke, published in 1665, and illustrated with thirty-eight full-page engravings. Mr. Thomas Brittain kindly distributed to the members mounted specimens of *Puccinia anemones*, Mr. Robinson tubes of *Fredericella sultana* and *Hydra viridis*, Mr. George E. Davis *Erysiphe Martii*, and Mr. Dunkerley several specimens of the larva of the Bacon Beetle.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.—The usual monthly meeting of this Society was held on July 7th, Dr. James Shackelton presiding.

In the absence of a paper for the evening, a general display of microscopical objects took place : Diatoms being shown by Mr. J. Spencer Smithson, Vorticellæ by Mr. J. Astin, Infusoria by Mr. W. Burton, Micro-fungi by Dr. James Shackelton, and Crustacea by Mr. J. Renshaw.

On Thursday afternoon, July 14th, this Society had the second of a series of Summer Rambles in search of micro-organisms.

Captain Hopwood of Hopwood Hall, near Middleton, having kindly granted permission for the members of this Society to ramble over the Hopwood estate and through the gardens, about a score of members met at the house of the Hon. Sec. (by whom they were conducted) at one o'clock, whence they proceeded by waggonettes to the "hunting ground." They were first shewn through the gardens and conservatories by the gardener, and upon leaving these were soon in bracket and bush, by the still pool and gurgling stream, waist-high amid ferns, sinking over shoe-tops in the soft treacherous mud of partially dried-up streamlets, turning over leaves, and obtaining dips here and there, for the place proved prolific of such life as the microscopist and naturalist delight in.

At 5-30, they made their way to the Hopwood Arms Hotel, where the host had provided tea. After which the tables were cleared, the instruments brought forth, and examinations of the finds were made.

Dr. J. H. Worrall, J.P., President of the Society, occupied the chair. The following objects were found :—

Lace Wing Fly.
Larva Dragon Fly.
Pupa ditto.
Larva Common Gnat.
Cypris tristriata vel *virens*.
Common Water Flea (*Daphnia pulex*).
Spineless ditto (*D. vetula*).
Great ditto (*D. Schæfferi*).

Cyclops quadricornis.
Vaulter.
Tubifex rivulorum—(Red Summer Worm).
Dytiscus marginalis
Gyrinus natator.
Paramecium aurelia.
Brown *Euglena viridis.*
Green *ditto.*
Vorticella microstoma.
Euplotes patella.
Amœba princeps.
Actinophrys sol.
Brachionus pala.
Rotifer vulgaris.
Pinnularia gigas.
Ditto major.
Navicula rhomboides.
Gomphonema elongatum.
Closterium lunula.

NOTES AND QUERIES.

Pond Scoop.—A scoop is often required for scraping the surface of the mud at the bottom of shallow pools, when searching for Oscillatoria, and other algæ. A convenient form may be seen in fig. 35. It is simply a ring of tin, five inches in diameter and

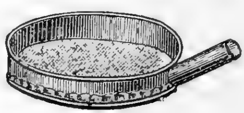


Fig. 35.

one inch deep. Both edges are wired, as the tinsmiths call it, and a ferrule is soldered to the side, so that it may be attached to a stick. Over the bottom is stretched a piece of thin muslin, which is tied over the wire ring, or coarse gauze may be used instead.—*Phin.*

Strassburger's Moist Chamber.—This consists of an ordinary slide upon which is placed a square or circular cell of porous cardboard soaked in water. The object for observation is placed upon a thin cover in a drop of water, and the whole is reversed upon the cardboard cell. By means of this simple device, Prof. Strassburger has been able to preserve for many days Spirogyra in conjugation. By moistening the cardboard cell from time to time the moist atmosphere can be easily maintained.—*J. de Phot. et de Micr.*

WIT AND HUMOUR.—The following appeared in "Scribner's Monthly," for Nov., 1879, and was republished in "Nature," in Dec. of the same year:—

A MICROSCOPIC SERENADE.

O COME, my love, and seek with me,
A realm by grosser eye unseen,
Where fairer forms will welcome thee,
And dainty creatures hail thee queen.
In silent pools the tube I'll ply,
Where green Conferva-thread lies curled,
And proudly bring to thy bright eye
The trophies of the Protist world.

We'll rouse the Stentor from his lair,
And gaze into the Cyclops' eye;
In Chara and Nitella hair
The protoplasmic stream descry,
Forever weaving to and fro
With faint molecular melody;
And curious Rotifers I'll show,
And graceful Vorticellidæ.

Where Melicertæ ply their craft,
We'll watch the playful water-bear,
And no envenomed Hydra's shaft
Shall mar our peaceful pleasure there;
But while we whisper love's sweet tale
We'll trace with sympathetic art,
Within the embryonic snail
The growing rudimental heart.

Where rolls the Volvox sphere of green,
And plastids move in Brownian dance,—
If, wandering 'mid that gentle scene,
Two fond Amœbæ shall perchance
Be changed to one beneath our sight
By process of biocrasis,
We'll recognise, with rare delight,
A type of our prospective bliss.

O dearer thou by far to me
In thy sweet maidenly estate
Than any seventy-fifth could be,
Of aperture however great!
Come, go with me, and we will stray,
Through realms by grosser eye unseen,
Where Protophytes shall homage pay,
And Protozoa hail thee queen.

JACOB F. HENRICI.

Since then it has travelled on the Continent, having been translated into the "Bulletin scientifique du Dep. du Nord," 1880, No. 2, and the "Union des Ecoles," published at Montpellier by M. Zolotovitz. Later in the year it was reproduced in the "Journal de Photographie et Microscopie," in the following words:—

SÉRÉNADE MICROGRAPHIQUE.

"VIENS avec moi, ma tendre amie, et visitons ensemble un royaume invisible à l'œil le plus puissant; tu y recevras un doux accueil, et les plus magnifiques de ses créatures te prendront pour reine. Ce monde est dans ce tube; je l'ai retiré d'un lac aux eaux tranquilles; les verts filaments des Conferves y ondulent gracieusement et apportent à tes beaux yeux les trophées du monde des Protistes.

"Pour nous le Stentor sortira de son sommeil; nous pénétrerons dans les profondeurs de l'œil du Cyclope et dans les filaments des Nitelles et des Chara; nous suivrons la delicate mélodie moléculaire des courants protoplasmiques. Viens, je te montrerai les curieux Rotifères et les gracieuses Vorticelles.

"Nous verrons les Mélicertes tendre leurs embuscades, les Infusoires badins folâtrer jusqu'à ce que le dard de l'Hydre vienne les interrompre dans leurs jeux paisibles; et, tout en murmurant un doux conte d'amour, nous suivrons avec sympathie le développement du cœur de le jeune Lymnée.

"Là tournent les sphères du vert Volvox; les molécules des Plastides sautillent dans la danse brownienne, et, au milieu de cette scène charmante, deux Amibes passionnés vont peut-être se réunir en un seul, agréable image du bonheur qui nous est réservé.

"Viens, douce amie, que l'éloignement me rend encore plus chère; nous visiterons ensemble un royaume invisible à l'œil le plus puissant, où les Protophytes te rendront hommage et où les Protozoaires te reconnaitront pour reine."

We have a proverb that "a rolling stone gathers no moss," also another which sets forth that "a snowball gathers much in rolling;" which of these is fulfilled in this case we leave our readers to judge.

ERRATA.—Mr. H. C. Chadwick wishes us to inform our readers that, at the last meeting of the Manchester Microscopical Society, he described the heart of *Gammarus pulex*, and not *Chirocephalus diaphanus*, as is stated in the Secretary's report. On page 172, line 35, for "intestinal," read "internal."

STAINING INFUSORIA—Picro-carmine does not sensibly color Bacteria, but it colors very clearly the nuclear formations contained in the bodies of Infusoria. After the coloring, glycerine can be added, and the preparation mounted in the usual way.

MICRO-FUNGI.—On Saturday, the 16th July, in a ramble along the valley from Buxton to Miller's Dale, I met with the following leaf fungi, specimens of which I intend to exhibit at the Manchester Microscopical meeting on the 4th August :—

Uredo miniata and

Xenodochus carbonarius on the larger burnet *Sanguisorba officinalis.*

Uredo cirsii and

Puccinia syngenesiarum on the common thistle.

Æcidium epilobii and

Puccinia epilobii on the Willow herb, *Epilobium hirsuta.* I have on former occasions met with them also on *E. montana.*

Æcidium compositarum on the colts foot in large quantity.

I also found some twenty or thirty plants of the insectivorous Butterwort, *Pinguicula vulgaris*, with thousands of insects imprisoned, and most of them partly consumed.—*Thos. Brittain.*

A NEW WORK ON PRACTICAL MICROSCOPY.—We are glad to announce that Mr. David Bogue, the publisher of "Science Gossip," has a work upon "PRACTICAL MICROSCOPY" in the press. It is written on the lines of "Quekett's practical treatise on the use of the microscope," is profusely illustrated, and will be sold at a very modest price.

MOUNTING INFUSORIA.—Will any of your readers kindly give me a receipt for making cells for mounting Infusoria, and also for fastening on the thin glass cover.—*R. F. A. Howorth.*

TRICHINÆ IN AMERICAN PORK.—To correct by positive and personal evidence the false and exaggerated reports which have been circulated in Europe with regard to the quality of American hog products, the State Department has had the business of hog raising and pork packing investigated by the Chief of the Bureau of Statistics. In accordance with his instructions the Commissioner visited representative hog-raisers, buyers, shippers, packing-houses, stock-yards, rendering establishments, health offices, and forwarding agents, and has now submitted his report, which will immediately be published by the Department for circulation in Europe.

Some of the conclusions arrived at in this report are as follows:—

That the percentage of American hogs infected with trichinæ—though this question is thus far largely one of supposition—is, in all probability, by reason of the superiority of the breed and feed, much less than that among the hogs in any other country.

That the freedom from trichinosis of the two great pork-consuming centers of the West, Chicago and Cincinnati, furnishes the strongest possible evidence of the purity of American pork. In

Chicago, for a series of years, in which forty thousand deaths were reported with their causes, only two cases of trichinosis were reported. In Cincinnati, during the same period, not one case was reported.

That the reported cases of trichinosis have resulted from eating uncooked meat shown to be inferior or rejected, and that thorough cooking entirely destroys this parasite and removes all danger in this regard from eating pork.—*Scientific American.*

SEPARATING FORAMINIFERA FROM SAND.—If dried sponge sand is sifted into water, slowly, all the foraminifera will sink, and the sand will float on the water. A slide dipped under the floating film of grains will bring up only sand. You may safely skim off and throw away all that does not sink with a little stirring. Then the sunken part should be dipped out, about a dessert-spoonful at a time, into a small saucer, and water enough to just fairly cover them put in, and all floating grains stirred down. Then by a circling movement of the hand the foraminifera will come to the surface, and by gradually tipping the saucer they can be worked to one edge of the little pile of sand, and thence carefully dipped up with a rubber bulb pipette. In this way they are obtained almost pure. Only a little sand must be washed at a time, or not all the foraminifera will be got out, and very little water must be used, or sand will get mixed with them. Much water moves the light sand, but a shallow wave seems not to stir it, but yet rolls the shells along. —*American Natuaralist.*

NEMATODES *v.* OSMIC ACID.—The Nematode, *Anguillula aceti*, can live a long time in a liquid containing osmic acid. In the case of a female the eggs develope and hatch, and the embryos grow at the expense of the mother, until nothing remains of her body but the outer cuticle, which resists all attacks of the acid. When the young Anguillulæ have pierced the cuticle and are free, they generally die in a few days.

A similar example is furnished by the larvæ of the Diptera, *Chironomus plumosus* Linn., which lives in water strongly mixed with osmic acid, owing to its cuticle resisting the reagent.

SELF FERTILIZATION—that is, the formation of the seed by the agency of a flower's own pollen rather than by that derived from some other flower of the same species, and brought to it by insects or other external agency—has, according to Mr. Darwin, the effect, after a time, of causing the disappearance—in other words, of preventing the formation of stripes and dots of color in the petals, and thus of tending to the production of self-colored or white flowers. As the necessity for attracting insects diminishes, so does the color which serves to attract them. Following Darwin, M.

Heckel points out that prolonged self-fertilization has a tendency to cause the flowers to become malformed—that is, double, and a certain degree of sterility is, in consequence, induced.

Cutting Sections of Myxomycetes.—In the study of the lower vegetable forms with naked protoplasm, Myxomycetes, for instance, osmic acid can be easily used. By the action of this reagent the currents in the protoplasm of Myxomycetes are instantly suspended, and in a few instants the plasmodium is sufficiently hardened to make sections possible.

Literary.—The July number of Transactions of the Hertfordshire Natural History Society contains a "Note on the Schwendenerian Theory of Lichens,"—" On a Species of Chætospira found at Hoddesdon," and a paper "On the occurrence of Red Snow in Hertfordshire." It is published by Mr. David Bogue.

Dipping Tubes.—To *H. G.* The tubes you enquire for may be obtained from any operative chemist. If you wish to make them yourself, procure some "glass tubing," and take a piece long enough to make *two*, of either A or B, Fig. 36.

Fig. 36.

Hold the centre of the piece in the flame of a bats-wing burner, and when quite soft, gently pull the ends away from each other. Cut with a file the narrowed portion and fuse the edges in the flame.

Bacillus.—A remarkable instance of the insidious and virulent nature of the poison producing "woolsorters' disease" is afforded by the death of a man named Baker, employed as an attendant upon a backwashing machine by Messrs. Sugden and Briggs, spinners, Bradford. On Monday week deceased's left arm was caught by the wheels and the skin abrased. He washed the place with some suds from the machine, and so absorbed some of the poison from the Van mohair, which was then undergoing its third washing, after having been prepared and combed. His arm swelled, and he was obliged to leave work on Friday, from which time he became rapidly worse, and he died on Wednesday, with all the appearances found in death from anthrax.—*Bradford Observer.*

BOTTERILL'S MICROSCOPIC LIFE SLIDE.—The advantages claimed for this slide (fig. 37) are the facility with which it can be used and

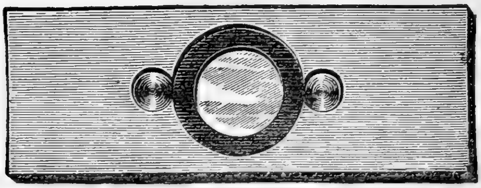


Fig. 37.

cleaned; its reversibility, allowing either side of the object to be examined through thin glass; the provision for renewing the supply of water without disturbing any part of the apparatus, thus enabling objects to be kept under examination for an indefinite period; the same arrangement also allowing of the introduction of colouring matters, as carmine, indigo, &c.; and, lastly, its moderate cost and durability.

For Confervæ, small Infusoria, &c., it is sufficient to place the object on the bottom glass, with a drop of water, and apply the covering glass in same manner as when using a glass stage-plate. When a thicker layer of water is required, a narrow ring of vulcanite, cork, or other suitable material, of the requisite thickness, should be placed on the lower glass, and the object put in position, and the covering glass applied just as in mounting objects in liquid in a cell. The supply of water can be maintained by putting a drop occasionally in one of the side "wells," keeping the slide, when not under examination, in a small damp chamber, to prevent evaporation. To change the water, supply through one "well," and draw out through the other by means of blotting paper.

Messrs. Thompson & Capper, of 4, Lord Street, Liverpool, were the original makers of this slide, and also of Botterill's Zoophyte Trough, which is illustrated by fig. 22.

NEW LAMP.—At a recent meeting of the Bath Microscopical Society, Mr. Braham displayed a lamp, which was simply a diminutive limelight with a plano-convex lens in front of it, and with a rack adjustment, so as to produce from the small pea of light a divergent, convergent, or parallel beam. The lamp was also fitted to a universal stand, so that like a rod it could be directed out to the object, and above and below it in any required position. The quantity and intensity of light could be regulated with the greatest ease. Mr. Braham stated that the lamp was fed by common coal gas, the oxygen gas united with it being pressed through a fine jet from a bladder. A bladder of oxygen gas, sufficient for an hour's

illumination, could be made at a cost of $1\frac{1}{2}$d., and the light would be much purer than from any oil lamp. At the close of the paper Mr. Braham exhibited numerous objects; coloured backgrounds, illuminated from an ordinary lamp, greatly assisted in the observation of details and markings.

CHARÆAS GRAMINIS.—The Clitheroe catterpillars, which were sent us by Mr. Pilling, of Blackburn, arrived as we were going to press with our last number. They were without doubt specimens of the *Charæas graminis*, or the *Cerapterix graminis* of Curtis. We placed them in our vivarium with products from the garden, lettuce leaves, bean, pea, currant, gooseberry, and cabbage leaves, but the next day not one was attacked; when, however, for these delicacies we substituted a freshly cut turf of grass, the creatures "set to" as if they had been kept without food for a month, soon demolishing the whole of the green portion.

Upon this subject Mr. W. E. Axon read a paper before the United Field Naturalists, at Greenfield, on June 19th, which was published in the *Manchester City News* for June 25th.

INSECT DISSECTIONS.—Will any of your correspondents tell me if there is any work specially treating on this subject, and on their preparation for examination under the microscope? I wish to know what are the instruments to be used, say to dissect and mount a *crane-fly*, and what powers to employ, whether a compound or simple microscope.—*G. H. J.*

DEBY'S IMPROVED GROWING SLIDE.—M. Deby has found that some operators have made a difficulty of constructing slides on his former pattern, he therefore publishes a much more simple device, a description of which we extract from the *Journal of the Royal Microscopical Society*. Take an ordinary glass slip, with a circular hole (say half an inch or more in diameter) in its centre, lay this slip on an ordinary glass slide, not perforated. Then grease the top of the perforated slide just a little way round the circular hole, and join the two slips of glass by means of two small rubber rings. The object is placed on a thin cover glass somewhat larger than the hole in the slide; it is then covered with a thin glass cover one-fourth of an inch in diameter, and the whole turned down and fastened to the slide by the adherence of the grease. When not under observation the slide is laid flat in a shallow plate with water just above the junction line of the two slips of glass.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

K. F. A.—We use nothing but cells built up of old gold-size, fastening on the cover with Brown Varnish, finally going over the whole with new gold-size. The Brown Varnish may be obtained from Mr. Ward, whose advertisement is upon the cover.

H. C. C.—You will see we have drawn attention to the subject of your note in our "Notes and Queries" column.

W. E. A. A.—Paper received; shall be glad to hear from you occasionally on the subject of microscopy.

. A. A.—Get "Ponds and Ditches," which may be had of any bookseller.

P. C. R.—The Journal of the Royal Microscopical Society will give you all the information you require on "Angular Apertures." We are afraid the subject would be too deep and uninteresting for the majority of our readers.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free.* They must reach us before the 14th of each month. Exchangers may adopt a *nom-de plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

Well-mounted slides of Palate of Cyclastoma elegans, in exchange for other good microscopical objects, mounted. M. Farhall, 3, St. John's-road, Dover.

INJECTED specimens of kidney, tongue, and liver, also very fine slides of human teeth, prepared according to the method of Dr. Bödecker, showing the protoplasmic net-work between the dentinal canaliculi, in exchange for first-class histological and pathological slides or other good specimens. J. L. Williams, North Vassalboro, Me., U.S.A.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

PHOTO-MICROGRAPHS of scientific value may be obtained from Mr. J. H. Jennings. 14 Beech Avenue, Nottingham. They illustrate structure of typical rocks and minerals, sedimentary rocks with forams, and subjects in entomology. Price 5s. per dozen, or in exchange for really good petrological or entomological slides.

VALLISNERIA SPIRALIS, assorted weeds and trumpet snails for aquarium, 8d. per dozen free. Mr. Keall, Chemist, Swansea.

IMMERSION OBJECTIVE.—A splendid one-fifteenth immersion objective, as good as new. Price £7. B., care of the Editor of THE NORTHERN MICROSCOPIST.

NITELLA TRANSLUCENS.—Will send some of this weed on receipt of mount or material. E. B. L. BRALEY, 2, Burlington Buildings, Redland Park, Bristol.

THE NORTHERN MICROSCOPIST.

No. 9. *SEPTEMBER.* 1881.

THE MOSQUITO AND GNAT.*

THE subject has been so well illustrated in the case of the English Gnat that I can hope to offer few observations with which the members of the Society are not already familiar. The resemblance, indeed, between the tropical Mosquito—the *Culex mosquito*—and the more familiar Gnat—the *Culex pipiens*—is so great, that one can well be studied in the other; and at the outset I must confess that so far as my own observations go there seems to be practically no difference between them, certainly not enough to render one readily distinguishable from the other.

The two following illustrations will serve to show the leading features of the East-Indian Mosquito, fig. 38 being the female and fig. 39 the male insect.

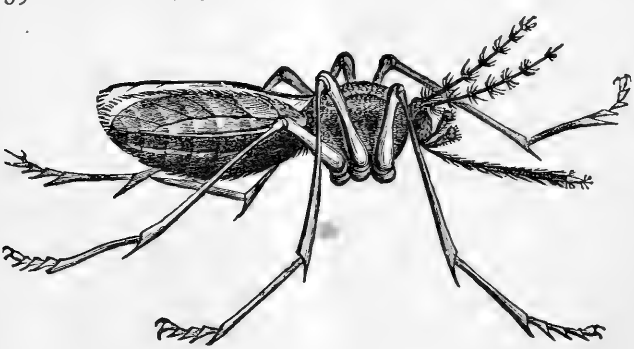


Fig. 38.

The Mosquito, like the Gnat, belongs to that family of Dipterous Insects called Culicidæ, of which the characteristics are, the possession of complex suctorial mouth organs, many jointed antennæ and palpi, a small head, and slender body with comparatively long

* A Paper read before the Manchester Microscopical Society, July 7th, 1881.

wings and legs. Of its larval and pupal stages I can only say,—in the absence at present of exact information—that they must resemble very closely those of the English Gnat, the successive developments being probably more rapid owing to the favourable conditions of tropical light and heat. The Gnat completes its growth from the egg to the perfect insect in from three to four

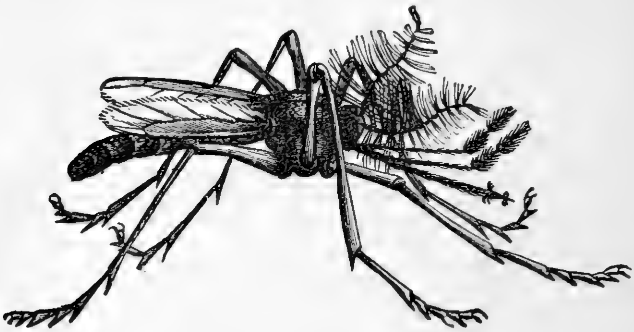


Fig. 39.

weeks. As is the case with so many of the insect tribes it is aquatic in its larval and pupal stages, but draws its supply of air direct from the atmosphere. The eggs are laid on the surface of standing water in curious boat-shaped masses, which float about until the larvæ emerge. The larva possesses a round flattened head, furnished with two simple eyes, a pair of powerful mandibles clothed with cilia and two tufted antennæ. The thorax is usually described as proportionately much larger, although in a mounted specimen I have, it is decidedly smaller. The abdomen is long and slender, composed of ten segments, of which the last two bend away from the body at a sharp angle, while from the eighth a remarkable tubular column is extended, containing two tracheal tubes, which, dividing at the base of the column, pass up along the abdomen and thorax to the head, branching freely. It is by this column brought to the surface of the water that the larva breathes. The ninth and tenth segments also possess tracheal branches, the latter terminating in an exquisite arrangement of fringed hair-like bodies, in shape suggesting an opened fan, from which spring four taper conical organs, each traversed by an air tube. In from two to three weeks the larva becomes the pupa. The head disappears within the thorax, which is greatly enlarged, while the abdomen is relatively very slender and usually seen curved round under the thorax. The abdomen has now only eight segments, and the curious terminal appendages of the larva give place to two flattened plates at the extremity of the body. The breathing apparatus is

transferred to the upper part of the thorax and consists of two slender columns, one on each side, containing air tubes connected with the entire tracheal system. When air is wanted, the pupa rises to the surface with the tubes just protruded, and so gets a supply. For the final transformation the pupa extends itself on the surface of the water, the thorax opens widely, and by a series of extensions and contractions the perfect insect draws itself out, extends its legs and wings and soon flies away. On examining this insect we are at once struck with the lightness and grace characteristic of its class. The six long slender legs, the delicate pair of wings, the small head and thorax, and the slender body, all unite in lending an appearance of elegance singularly unsuggestive of the bloodthirsty instincts of the little creature. The abdomen consists of eight segments, and tapers to a blunt point, presenting characteristic differences in the two sexes. The wings possess a very fine set of nervures, which, as well as the free edges, are thickly set with the well-known scales, about the markings of which there has been so much controversy. These scales, indeed, are present all over the body, and vary in shape with their position, but all exhibit a series of parallel longitudinal ridges, with the interspaces transversely striated. It is possible that the peculiar sound produced by the Gnat, and still more clearly by the Mosquito, is due to the number and position of these scales upon the wings. The legs, eight jointed and terminating in a strong double hook, are profusely supplied with scales and hairs. Coming to the head, we find the upper surface and sides almost entirely occupied by a pair of compound eyes. No ocelli are visible. From two bulbous bases at the front spring the antennæ, consisting in the female of thirteen joints nearly equal in length and sparsely set with hairs. In the male there are fourteen, short at the base, but gradually lengthening up to the twelfth, the remaining two being much longer, so that together they almost equal the rest in length. From the first twelve joints radiate sets of long curved hairs, which impart an extremely elegant plume-like appearance to the antennæ. The fourteenth is somewhat thickened and studded with minute downy hairs quite different from the others. Can it be that the last segment is the organ of smell? Just below the bases of the antennæ are a pair of three jointed labial palpi, long and slender in the male and covered with hairs and scales; but in the female short and club-like. Between and below these are the oral organs. The most noticeable of these is the thick proboscis-like projection readily visible to the eye and almost half the length of the whole insect. This is the labium, the homologue of the under lip. On examination, it is found to be semi-tubular, with a divided bulbous extremity, and completely covered with closely-set scales and hairs. It is in fact the sheath for the piercing apparatus next to be described.

Above and placed against the concavity of the labium, in which it lies, is the labrum, or upper lip, a transparent chitinous sheath, tapering to an acute point. In this are found five delicate filaments of great tenuity and transparency, readily defined under, say, a quarter-inch objective into a pair of delicate blades with a keen edge and strong scythe-like back, ending in nine or ten well marked saw teeth and a needle point. These are the mandibles. Next we have another pair of thin blades, also with a strong back, but without teeth and with a somewhat rounded point—the maxillæ; and lastly the suctorial organ—the ligula or tongue—a filament with a spear shaped head, traversed by a clearly marked tube throughout its entire length. The extreme delicacy and beauty of these various parts defy description. They must be seen and examined under the microscope to be duly appreciated. Now it is a remarkable fact that the female Gnat or Mosquito alone possesses a full complement of oral organs. The male is destitute of mandibles, maxillæ, and ligula. He cannot therefore bite, and is quite a harmless inoffensive creature. If we are so unfortunate then as to be bitten, we may be sure that our guest is a female. In British Guiana, to which my remarks principally refer, and elsewhere in South America and the West Indies, there exists a variety of the Mosquito remarkable for its greater size and ferocity, and differing from both *Culex mosquito* and *C. pipiens* in having labium, abdomen, and legs clearly marked with bands alternately dark and light coloured, this appearance being due principally to the arrangement of the scales. It is known as *Culex pulicularis*—locally as the Gallinipper. It is fortunately much less abundant than the common Mosquito which flourish in enormous numbers, varying with the season of the year and local conditions. These are most numerous after the longer and shorter rainy seasons, March perhaps being the month most congenial to them, and again, along the coast and up the rivers as far as the tide extends. Stagnant waters and mud seem to be a necessity, as in the upper reaches of the streams, where there is a steady flow of clear, fresh water, they are comparatively rare. There seems to be a periodicity also about their daily movements governed to a considerable extent by the prevailing local winds. They swarm out in the evening, at sunset, for three or four hours, then follows an interval of rest until, say, five in the morning, when they again turn out, to retire again about eight for the remainder of the day. In the rainy season, however, when there is little or no breeze and a dull, close atmosphere, they are present throughout the entire day and night, but still in greater numbers at the times mentioned. Europeans, especially new arrivals, suffer severely from Mosquito bites, as do the negroes, and, I am assured, the aboriginal Indians themselves. It is curious to note the difference in the after effects observable in different indi-

viduals. Some readily become seasoned though perhaps suffering much at first, others are equally affected year by year, while a fortunate few escape entirely or very nearly so. The bloodthirstiness of the Mosquito is surprising. If allowed to remain unmolested on the part attacked it will gorge itself with blood until it rolls helplessly over. The bite produces a small pimple with a minute red point which remains for a longer or shorter time differing in various individuals. According to Réaumur, when the puncture is made a poisonous fluid is secreted by the insect, and he considers that it is to this that the disagreeable consequences of the Mosquito or Gnat bite are to be ascribed. This view however does not appear to have been actually confirmed. It should be noticed that only the labium with the lancets and ligula enter the wound. The proboscis-like labium may be seen to curl up under the head when the insect is feeding, and serves in fact, only, as a sheath for the other organs.

J. B. PETTIGREW.

MICRO-FUNGI IN SEPTEMBER.

THE autumn of the year is the great harvest of the student who pays especial attention to micro-fungi. It is then that the leaves of trees, and vegetation generally, begin to decay under the blighting influence of a lower temperature, and as they lose their vitality they become the abodes of a new vegetable kingdom, which may not improperly be called the invisible kingdom, for so far as the world generally is concerned, it is altogether unknown and uncared for. With the decay of ordinary vegetation we lose one of the most lovely aspects of nature, but to the microscopist this is not altogether a loss; there is a happy compensation for him in the marvellous wonders he finds in the new world brought into existence by the decay of the old. In the earlier portions of the year the micro-fungi he was able to find were upon healthy, perfect leaves, and comparatively few; now their number is legion, and they are found on dead and dying vegetation all around him wherever he may care to look for them. It would be vain in me to attempt to refer to all the numerous species which now make their appearance: the catalogue would be far too long for this short article, so I must confine myself chiefly to the notice of what I have myself met with in my rambles, or such as I have come upon unexpectedly. Still, as almost every locality is the home of special plants, microscopic or otherwise, it may be well to refer to such micro-fungi as may be easily recognised by the student.

By this time most of the Uredos are over, the one on the larger burnet still lingering on in connection with the beautiful chain-brand referred to in the last number of THE NORTHERN MICROSCOPIST, but several others have come to the front, amongst them *Uredo quercus*. On the underside of oak leaf this has been found in Sherwood forest and elsewhere, but I have never heard of it being found near to any of our large towns. The same remarks will apply to the bilberry fungus, *Uredo vacciniorum*, which is a native of the mountains or the moors. The fern uredo, or *Uredo filicum*, I have met with frequently on *Cystopteris fragilis*, but I still believe it is rare, as I cannot hear of others finding it. I have a specimen on *Scolopendrium vulgare* which was supplied me by a friend. In last month's notice of leaf-fungi, I spoke of *Xenodochus curtus* found by me, and not since met with, and I now desire to refer to it again for the purpose of correcting a slight mistake in Dr. Cooke's account of it. He states that the *Xenodochus curtus* was found near Manchester, whereas it was found within a few miles of Bakewell, and I am glad to have this opportunity of explaining the place where I found it, that others, when in the district, may look out for it.

On the high road from Buxton to Bakewell, the traveller passes through the village of Taddington. As he leaves this village, in descending a hill in the direction of Bakewell, he passes a wood on his left hand side. It was in this wood I met with the minute Xenodochus, *X. curtus*. I have frequently since laboured in vain to find further specimens, and it will give me pleasure if I can hear of any of my readers being more successful.

Amongst what may be termed the autumnal Uredos is one on the Enchanter's Nightshade, *Circæ lutetiana*. This I once met with in beautiful condition in a wood at Matlock. The wood is on the left bank of the river Derwent, which has to be crossed by a boat. There is a remarkable circumstance connected with all these later Uredos, namely, that the spores are extremely minute. If the student will be at the trouble of comparing the spores of *Uredo miniata*, or any of the earlier species, with the spores of any autumnal kind, he will at once recognise the great difference.

Many of the fungi referred to in last month's paper are still to be found, especially *Erysiphe montagnii* and *E. Linkii*. Last year I found these in great plenty as late as October. It is only when the plants on which they live have been destroyed by the frost that they altogether disappear.

Amongst Pucciniæi named in former papers, some are over, but many remain to reward the botanist, and amongst them are many that I have not previously referred to; amongst them *Puccinia polygonorum*. This I have never met with in good condition but once, and that was so far back as the autumn of 1863, now eighteen

years ago. *Puccinia galiorum*, Bedstraw brand, on *Galium aparine* should be looked for now and also in October, as I found it last year in the latter month. The asparagus brand, *P. asparagi*, may now be met with. I have once found it when stopping at Ashford-in-the-Water, near Bakewell. The Iris Puccinia, and others named by Dr. Cooke, I have never yet been able to find.

In looking over my own gatherings of micro-fungi I have frequently been reminded of the fact that a considerable number of them I have met with but once, while others come to the front every year as regularly and as plentifully as daisies or buttercups. Some that I once thought very rare I now find frequently, and some others that I felt inclined to think common I have never met with. Probably this also may be the experience of other students. The only wise plan of research is for the student to look out every where whenever an opportunity arises in both likely and unlikely places, and he will not unfrequently be rewarded by finding in the latter unexpected treasures, which will amply repay him for any trouble he may have taken.

THOMAS BRITTAIN.

USEFUL APPARATUS.

AYLWARD'S "CONCENTRIC" TURNTABLE.—Having had the opportunity of examining this instrument upon several occasions, we have no hesitation in saying that it will be found to possess for the practical microscopist many advantages over the forms of self-centering turntables that have hitherto been before

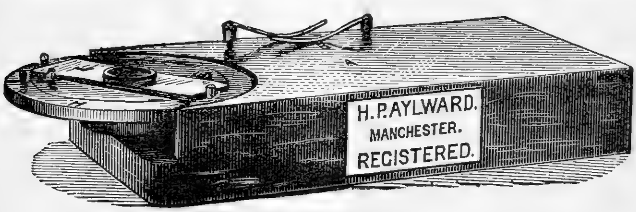


Fig. 40.

the public. It essentially consists of two plates, the inner revolving on a pivot, whilst the outer revolves concentrically on the inner, a few small pins being so arranged that by a single turn of the outer ring they firmly grasp the glass slide, and cause its centre to exactly coincide with the centre of the turntable, whilst a simple reverse movement instantly liberates it. This turntable answers for

slides of various widths, from 1 inch to $2\frac{1}{2}$ inches, it is strongly made, well finished, and of excellent workmanship throughout, besides which loose springs are supplied, fitting into corresponding holes in the turntable, convenient for making rings in any other position than that of the true centre of the slide.

This instrument is shown in fig. 40, the letters being explained as follows :—

A.—Ordinary wood block with steel pivot, on which the brass table revolves. B.—Two brass springs which fit into holes in the table, and may be used when the slide is required to be out of centre; when not in use they fit into holes in the wood, as shown above. D.—Revolving table, with milled wheel below for rotation. H.—Brass annulus or ring which revolves concentrically on the table D: on the ring H are screwed two conically headed pins J J, $3\frac{3}{32}$ of an inch apart exact, to allow the 3×1 slip to be placed diagonally between them. F F.—Two similar pins in plate D, so placed, that upon revolving the ring H they, in conjunction with the pins J J, firmly grasp the opposite corners of the glass slip, and cause the centre to coincide with the centre of the table D. I.—Brass pin for more easily revolving the ring H, for securing and liberating the glass slip, which is done by moving the ring H in the opposite direction.

PARKES' MICROSCOPE LAMP WITH COOLING EVAPORATOR.—This Lamp, independently of its patent cooling arrangement, will be found to fulfil all the conditions of most lamps hitherto constructed for microscopic use; with the addition of an effective shade and reflector. With the shade may be used the patent evaporator as shown in fig. 42, which prevents the radiation of heat upon the observer's head, and, by the gentle and imperceptible evaporation of the water contained therein, the surrounding air is moistened, and thus rendered less irritating to the eyes and respiratory organs.

These facts may be readily demonstrated by placing a thermometer, say eight inches from the lamp, when it is first lighted. This should be on a level with the top of the shade, which is the usual position of an observer's head when using the microscope. It will be found that after the lamp has been burning an hour, the thermometer will only indicate a rise of three or four degrees, whereas, with most lamps having a terra cotta or metallic shade, the temperature would be raised from twelve to fifteen degrees.

C is a bronzed copper cylindrical shade, $3\frac{1}{4}$ inches diameter, with hood at front to prevent the upward reflection of light. At the back is a parabolic reflector, which will slide out for cleaning, and, when desirable, a disc of cardboard may be placed over this reflector, for "white cloud" illumination. At the front is a tinted

glass "light modifier," which is secured by a bayonet joint, and may also be removed when necessary.

D is the cooling evaporator, constructed of thin bronzed copper, and covered by a lid of perforated copper. A layer of thick felt is placed inside for *saturation.* This vessel, filled with water, and placed over the shade as soon as the lamp is lighted, at once checks the usual accumulation of heat, and its use, during a long evening, will prevent an annoyance which is often felt by the microscopist.

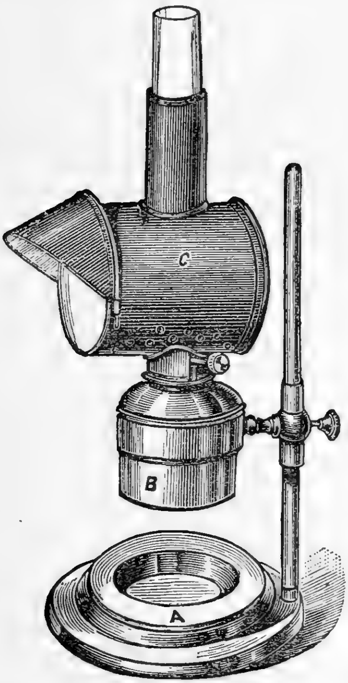


Fig. 41.

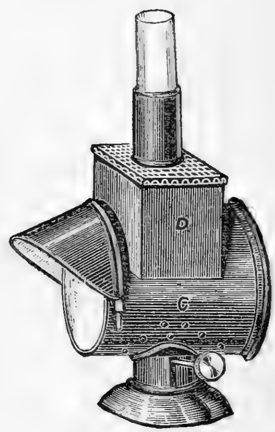


Fig. 42.

With regard to the light given by this lamp, it may be remarked that the reflector, being parabolic, transmits nearly parallel rays, which is a great advantage when low powers are used; at the same time, in consequence of more perfect combustion, resulting from shape of chimney and arrangement for the ingress of air, an abundance of light is supplied for the higher powers, and, if necessary, this may be concentrated by placing an ordinary stand condenser before the tinted glass front.

We have seen several of these lamps in use, and can testify to their coolness during working.

PARASITE OF VORTICELLA.

AT the usual monthly meeting of the "Rochdale and Whitworth Microscopical Society" held on July 7th, an interesting feature in connection with the Vorticella was shown by one of the members. On a piece of *Myriophyllum spicatum* obtained from a canal in the neighbourhood, there was found a fine cluster of *Vorticella nebulifera*, the stem of each individual being thickly studded with a number of small roundish bodies, new to all the members present.

I have since found numbers of the same object myself, and I think fairly made out its form.

Under a 1″ objective of 27° (Wray's), I found that the stems of the Vorticellæ were thickly studded with a number of roundish semi-transparent bodies, of which it was impossible to make anything very definite with the power used. It was however noticed that when the stems of the Vorticellæ contracted they did so more slowly and less completely than usual, as if there were some hindrance to their perfect action. A ¼ inch of 140° with a C eyepiece was then tried, and by these means, and by carefully adjusting the mirror, so as to get the requisite obliquity of the light, I was enabled to find that they had the shape and appearance

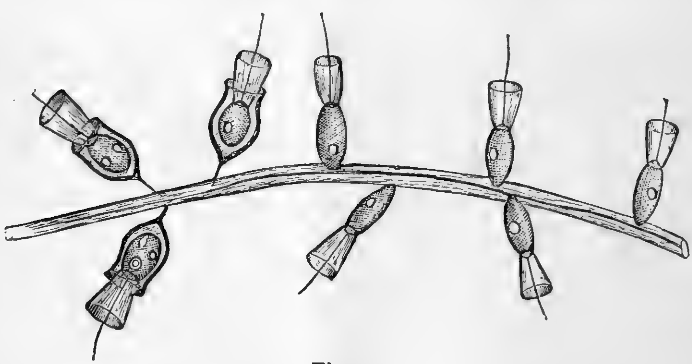


Fig. 43.

of a minute Vorticella. These minute organisms were attached to the stems of the large Vorticellæ in different ways; some had a stem considerably longer than the body, in others the stem was much shorter, and in others again no stem could be discerned at all. The body of the organism was tinged slightly green. From the upper part of the body I could just discern what might be a wreath of cilia, but I could distinguish no ciliary action or currents.

If any brother microscopist should have observed them or knows anything of them, his observations would no doubt be interesting to the readers of this Journal.

WILLIAM BURTON.

We have not the slightest doubt but that the organisms attached to the stem in question belong to the group of collared Monads, so beautifully illustrated in Part I. of Mr. Saville Kent's Manual of Infusoria (now publishing). Upon plate IV., figs 12 and 13, are given illustrations of *Monosiga Steinii* found attached to a stalk of *Vorticella convallaria;* and *Salpingœca convallaria* on the stem of an Epistylis, both amplified 650 diameters, of which we give a rough drawing at fig. 43.

We have not reproduced Mr. Burton's drawing, as we imagine that upon further investigation the two projections noticed were only the lateral edges of the extended collar, and finding these observed we are surprised that the presence of a central flagellum was not also demonstrated. All microscopists interested in these organisms should procure Mr. Saville Kent's work. Mr. Kent concurs with this opinion.

A WORKING MICROSCOPE.

AFTER the issuing of a circular previous to going to press with our first number, a correspondent enquired whether we could see our way to give a series of articles on "How to select a microscope," to which we replied in our answers to correspondents. Now the selection of a microscope is a moot point with most microscopists, but nearly every one who has had much experience will perhaps admit the use of a small, yet good instrument for general use. For travelling, Society demonstrations and dissecting, a microscope with a short body, but capable of extension by means of a long draw-tube, so that it may yield the full amplification of an ordinary instrument, yet capable of being shortened in order that the dissector may sit well over it, is a great convenience.

There are many forms of cheap instruments, and those somewhat of the pattern shown in fig. 44 may be pronounced the best; the "Economic" of Messrs. R. and J. Beck, the "College" of Messrs. Swift and Son, and the "Histological" of Mr. Collins. They are all remarkably steady, being hung on the Jackson model, can be used with moderate powers, and all have the Society screw for objectives.

Some operators have asserted in public print that a large and expensive stand is not necessary, and that more work has been

done with cheap instruments—to much of this we concur if allowed to ask the quality of that work, or the powers used; it is one thing to work at mosses with a small and light stand, using the two-inch or one-inch objective, and another to be able to investigate subjects requiring the use of high powers, say from the $\frac{1}{4}$inch upwards.

The writer's experience is, that for the practical microscopist, it is absolutely necessary to be provided with a "knockabout"

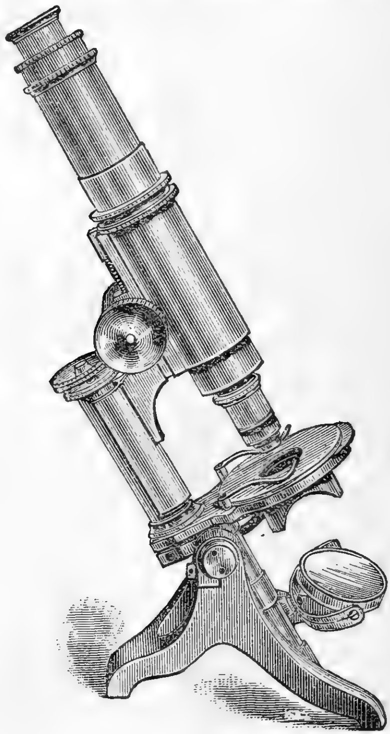


Fig. 44.

microscope for the purposes already mentioned: one which may be used with powers up to the half-inch or occasionally with the quarter-inch; but if it be wished to use objectives of higher amplification than this, he would certainly recommend the best stand obtainable.

It is not in this latter direction, however, that we expect to be of any use to our readers—the cheaper instruments already mentioned are generally made with tubes to take the continental eye-pieces, which being of small diameter the field is limited in size; then,

again, the absence of a coarse adjustment in many of them may for some purposes be found inconvenient, while the fitting below the stage should be made removable. On the other hand, the short tube gives a larger field when used with the camera for photo-micrography, and is also more convenient as a dissecting microscope, lengthening as it does the anterior conjugate focus, and thus giving more room for the needles.

Recognising these and several other advantages, the writer had an instrument constructed after the pattern shown in fig. 44. The draw-tube is wide enough to take the full size Ross eye-pieces, and when it is fully extended the whole forms a body of ordinary length. The stage, together with the body, is made to move round the optical axis as a centre, though this is perhaps unnecessary for most purposes. There are coarse and fine adjustments, a diaphragm in the thickness of the stage and plane and concave mirrors.

When standing vertically, and closed down the upper end of the eye-piece is eleven inches from the table, the collar in which the body slides is three inches in length, and lined with velvet. The body is 5 inches long, and the draw-tube $4\frac{3}{4}$ inches, with a diameter of 1.3 inches, the mirrors are 2.2 inches in diameter, and the fine adjustment raises or depresses the entire body $\frac{1}{100}$th of an inch for each revolution.

Of course we are perfectly aware there is no universal guage for eye-piece diameters or for substage fittings. It is a thousand pities that the Council of the Royal Microscopical Society do not bestir themselves in the matter, having done such good work in years gone by, in the direction of the universal screw for objectives.

We would like to see all our leading makers producing a microscope stand to take their full size eye-pieces on the lines we have indicated. Such an instrument might be sold for six pounds, together with an A eye-piece, including also an adapter for those who wish to use continental eye-pieces. A microscope of this kind we would be always willing to recommend, serving as it would for years of work with low and medium power objectives.

THE MICROSCOPICAL APPEARANCE OF THE VALVES OF DIATOMS.

By Julien Deby.*

A Study of the Genus Amphora.

In the genus Amphora we meet with curious and peculiar appearances, produced entirely by the innate difference in the structure of the valves. These cannot be better understood than by the use of sections and diagrammatic projections, similar to those by which the genus Nitzschia has already been illustrated.

A transverse section through the centre of an isolated valve of Amphora presents a convex outline like a large segment of a circle. The valve has upon its surface a longitudinal line or *raphe*, smooth

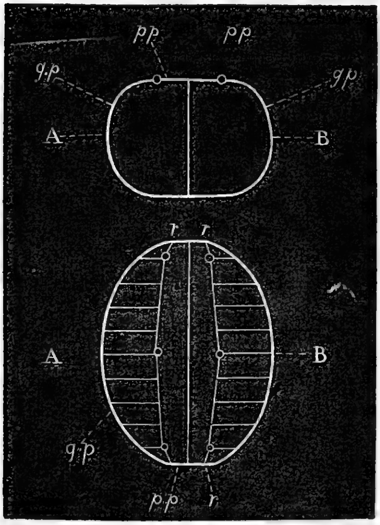


Fig. 45.

Section through A—B.
p.p. Small flaps *(petits pans)*
g.p. Large flaps *(grands pans)*
r. Raphe *(raphé)*

and eccentric. This raphe is furnished with a small central nodule, or in some a *stauros* (a linear thickening perpendicular to the longitudinal axis of the valve) and generally a smaller nodule near each extremity. This longitudinal line is in the genus Amphora sometimes straight, but oftentimes curved or double curved, varying according to the species.

* Translated from the *Annales de la Société Belge de Microscopie*, t. vi. Memoires.

On the exterior side of this line is to be seen a large flap, excessively convex, and on the interior side a smaller stunted flap. Fig. 45 shows this arrangement in section and in projection.

The small flap is always of relatively small breadth, and its curvature very trifling; it is curved, doubly curved, or straight on its external surface, according to the contour of the raphe with which it is in contact, while its opposite side is always straight, or has merely the slightest curve. Fig. 46 shows some of the common forms of the smaller flap of the Amphoræ. Its surface is

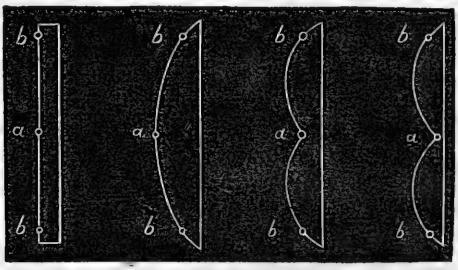


Fig. 46.

a. Central nodule *(nodule central)*
b. Nodules at ends of raphe *(nodules terminaux du raphé)*

smooth or bears, in general, different designs to those which ornament the large flap.

In a complete but very young frustule the two small flaps touch each other on their free edges, while on the opposite side the two large flaps are equally united by a line of unbroken contact. This is the reason that when an Amphora is placed in the focus of a microscope under a high power, that we see simultaneously the two raphe as well as its two smaller flaps—that is to say, if it is lying upon its back, or on the line of junction of the large flaps. If the frustule be turned over it only shows the two large flaps, or rather the posterior parts of these, as well as their line of contact, which, however, is often very difficult to distinguish.

No trace of raphe, small flaps, or nodules are then visible, unless it be through the whole thickness of the frustule, by virtue of its transparency, under an objective having considerable penetration, a circumstance not infrequently occurring with these small diaphanous objects.

In the case of adult Amphoræ—as with all other diatoms—each valve is united to a hoop which encircles it round the whole periphery in such a manner that the careful observer will not fail to notice it, if he examine the frustules some time before the commencement of subdivision.

The diagrammatic section and projection of an adult frustule of Amphora may be seen in fig. 47.

It often happens with preparations which have been boiled in acid, that the valves have lost their hoops, and are consequently found separated from each other. In this case they usually lie upon the most convex side of the larger flap, so that these may

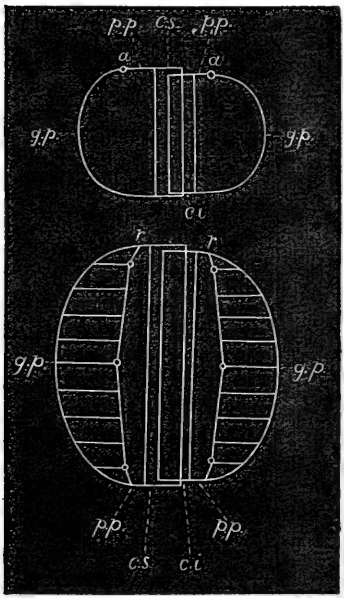


Fig. 47.

g.p. Large flaps *(grand pans)*
p.p. Small flaps *(petits pans)*
c.s. Outer hoop *(connectif supérior)*
c.i. Inner hoop *(connectif inférieur)*
r. Raphe *(raphé)*
a. Central nodule *(nodule central)*

often be seen in a more or less oblique position, 1st, a small flap; 2nd, the raphe with its three nodules; 3rd, the upper part of a large flap; 4th, a part of the interior surface of the last which projects beyond the free edge of the small flap. In other words, we see at the same time in this last instance the upper portion of the great flap outside the raphe, and a portion of variable and lesser breadth of the internal surface of this same flap—a circumstance occasionally producing appearances which, at first sight, are somewhat difficult of interpretation.

Fig. 48 shows us a case of this kind. When the hoop is attached to the valve, the view is complicated by the addition of lines representing its point of junction with the valve, as well as its free edge.

A little attention is sufficient to unravel all these details, which

are difficult to those only who have failed to grasp the general organization of the diatom frustule.

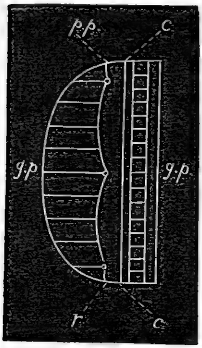


Fig. 48.

g.p. Large flap *(grand pan)*
p.p. Small flap *(petit pan)*
g'.p'. Interior portion of large flap reaching beyond the small flap *(partie interieure du grand pan dépassant le petit pan)*
c. Free edges of the hoop *(bords libres du connectif)*

It may also be remarked that many Amphoræ—just as is noticed in other genera—show hoops divided in a circular manner, so that

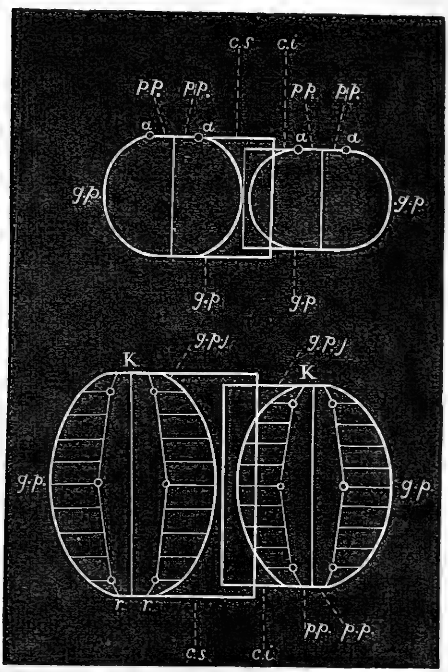


Fig. 49.

g.p. Large flaps *(grands pans)*
g.p.j. Young large flaps *(grands pans jeunes)*
p.p. Small flaps *(petits pans)*
p'.p'. Young small flaps *(petits pans jeunes)*
r. Junction line of the smaller flaps, old and young *(ligne de jonction des petits pans anciens et jeunes)*
c.s. Outer hoop *(connectif superior)*
c.i. Inner hoop *(connectif inferieur)*
a. Central nodule *(nodule central)*

they exhibit a series of fine multiple and parallel striæ instead of a single siliceous ring attached to the edge of the valve. Certain

species show regular points or designs upon the connecting zones.

Reproduction by binary division occurs in this genus, in the usual manner, viz.: by the formation of two new valves in the interior of the hoop of old ones. Fig. 49 gives the view of an Amphora in process of subdivision.

At the commencement of the phenomenon, by reason of the short distance the hoops are able to slide, and also on account of the limited space which exists between the parent valves, it frequently happens that the young frustules take a somewhat oblique position, and their shape seems to be more or less flattened on account of it. The effects of this compression gradually disappear, so that at the moment of liberation, the new frustules have completely acquired the appearance of the parent valves.

The valve of an Amphora does not differ essentially from that of a Navicula except in the extreme eccentricity (*l'excentricité extrême*) of its raphe; which is easily understood if we imagine a sufficient unilateral displacement of the central line and its nodules in this latter species, and an increase of its convexity necessary to bear this new line upon the exterior side or hoop of the frustule.

The link between the Naviculæ and the Amphoræ is furnished by the Cymbellæ (see fig. 50).

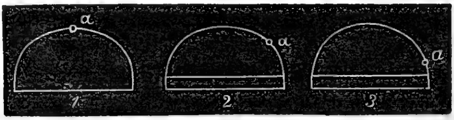


Fig. 50.

1. Section of a valve of Navicula.
2. ,, ,, ,, Cymbella.
3. ,, ,, ,, Amphora.

The eccentricity of structure in the Amphoræ differs essentially, by its nature, from that of the Nitzschia noticed in a previous paper, in that in this instance the two small flaps of the same frustule are in contact; while with the Nitzschia a large flap is always found to lie contiguous to the small flap of the other valve. Moreover the absence of a carina, the presence of a raphe and nodules, as well as the nature of the endochrome, set the genera Amphora and Nitzschia far apart from each other in all methods of natural classification.

The inner structure of the valves in the case of the Amphoræ, differs according to the species; from the delicate membrane which scarcely resists treatment even with diluted acids, to forms presenting a degree of solidity which might be called polycistinic, from their massive and crystalline aspect. The species of this

class are very diversely adorned by nature, their markings being very varied and generally characteristic for certain groups.

A good monograph of this genus by Professor H. L. Smith may be found in "The Lens," and this observer seems to have been the first who noticed the structure of the Amphora frustules. The "Atlas of Diatoms" by Ald. Schmidt contains a large number of beautiful and more recently discovered species.

The late Dr. Gregory in his work on the diatoms of the Clyde had previously described and figured many new marine species. Since then M. Grunow, M. Cleve, and various other naturalists have considerably increased the list.

Habirshaw's valuable catalogue of diatoms will furnish a complete list of the numerous species of Amphoræ, described and figured by all authors up to a recent date, with an index of the page of text in these works and the number of the plates and figures which bear upon it. The reader who is desirous of entering more deeply into the study of this interesting class is referred to the works of these able specialists.

OUR BOOK SHELF.

PROCEEDINGS of the Liverpool Naturalist Field Club, 1881.

This is a small brochure of 88 pages, containing the President's Address, resumé of excursions and evening meetings, with a list of the most interesting plants *noticed* during the excursions in 1880, while last and not least is appended a list of books useful in the study of Natural History, and their prices and publishers. There is one omission, however, a publisher's name should always be attached to these "Proceedings," so that the outside public may be able to procure them easily if it wishes.

The President's Address is full of interest; it is entitled ANIMAL DEFENCES, INVERTEBRATE ANIMALS, and he proceeds to show that the whole economy and morphology of animals and their prey, "from a flea to a whale," has been modified through the necessity of obtaining suitable food and protection. The volume is illustrated: we find cuts of *Difflugia carinata*, sting-thread of *Hydra vulgaris*, the locust, *Coreus bicolor*, *Diactor bilineatus*, and a very fairly executed plate of *Pentacrinus Mulleri*.

THE MICROSCOPE in its relation to Medicine and Pharmacy. Vol. I., No. 3, August, 1881. Ann Arbour, Michigan.

This is a bi-monthly American Magazine, and we scarcely have

made up our minds whether it is intended as a scientific or serio-comic journal. There are one or two good articles contained within its pages; but very many things we certainly object to. We shall probably abstract for next month a paper, "The Bacteria Fallacy Illustrated," in order to see what is thought of it on our side; but we do not quite see what the following cutting has to do with Microscopy—it appears to refer more to the advertising columns than to this science:—

"Now that the warm season is with us, bringing its usual discomfort and actual disease, we would call the attention of our professional readers to a remedy which we have used in cholera infantum with marked benefit. Physicians have reported in its favour from every direction. We refer to Lactopeptine, the formula of which can be found on our advertising page 17."

"Maltine," who is a two-page advertiser, has half a page of matter on page 77, devoted to his interests. A microscopical journal seems hardly the place to puff quack medicines. The "items" too might be omitted with considerable improvement to the journal.

REPORT AND TRANSACTIONS of the Birmingham Natural History and Microscopical Society for the year 1880.

This is an interesting *brochure* of pp. xlvi., 96, containing the Presidential Address, the Annual Report, and the Transactions. The head quarters of the Society are at Mason's College, where all communications should be addressed. Amongst the papers which have been read before the Society are to be found—*Dendrosoma radians*, by J. Levick; Notes on Marine Infusoria, by W. Saville Kent; On the Habits and Life History of *Leptodora hyalina*, by Dr. A. Milnes Marshall; British Lichens, by W. Phillips; On the Structure and Life History of *Volvox globator*, by A. W. Wills; On *Leptodora hyalina*, by W. P. Marshall; List of Desmids found in Sutton Park, by A. W. Wills; Where to find *Anuræa longispina*, by J. Levick; Sponges, by H. J. Carter; On a rare British Entomostracon, by H. E. Forrest; The Cryptogamic Flora and Hepaticæ of Warwickshire, by J. E. Bagnall.

NORTHERN SOCIETIES.

BOLTON MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER NATURAL SCIENCE ASSOCIATION. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LIVERPOOL MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER CRYPTOGAMIC SOCIETY. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER SCIENCE ASSOCIATION. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. NORTH OF ENGLAND MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. Hon. Sec., Mr. B. W. Wood. Meets on the First and Third Friday in each month.

NOTICES OF MEETINGS.

MANCHESTER MICROSCOPICAL SOCIETY.—The holiday time of the year (many members being away from home), and the weather favourable and more suited for outdoor pastime and recreation than close inside gatherings, for once had an appreciable effect on the attendance of members; and had it not been for the presence of some score of visitors, who attended by special invitation, the meeting would have been rather dull. By arrangement, all business of a routine character was as far as possible dispensed with, and, in the absence, therefore, of a paper or lecture on any special subject, there remained only the occupation of examining a number of interesting slides exhibited by a dozen gentlemen who generously answered the call of the committee and attended with their instruments. Amongst a number of objects—including *Leptodora hyalina* (both sexes) from Derwentwater, head of male Asiatic mosquito, and various beautiful polarizing objects—one slide was of special interest, and deserves more than a passing notice, both from a scientific point of view and as a handsome microscopic object. This was a double-stained section of the heel of a child, showing the glands of perspiration and structure of skin. Situated just beneath the skin, and found in almost every part of the surface of the body, are disposed sweat glands—small globular masses from which there ascends spiral conducting tubes which penetrate and have openings on the surface of the skin. Something like an idea may be formed of the number of these glands when it is estimated that three thousand five hundred and twenty-eight exist in a square inch of surface of the body. It is no unusual thing in microscopical text-books to see excellent drawings representing wonderful and beautiful structure in minute portions of both the animal and vegetable world; but perfect slides, like the one in question, showing beautifully and in detail structure microscopically small and difficult to mount, are in a sense rarities. This section was exhibited by Mr. Thos. Brittain; it is a fellow-section to the one which was exhibited by Messrs. Smith and Beck at the microscopical soirée held at the Gentleman's Concert Hall the last time the British Association met in Manchester. The following gentlemen were exhibitors:—Messrs. John

Boyd (President), Thomas Brittain, W. M'Nally, D. Alston, J. W. Dunkerley, A. W. Duncan, A. J. Doherty, R. L. Mestayer, J. B. Pettigrew, H. Hall, J. C. Barker, and Alexander Hay.

MANCHESTER CRYPTOGAMIC SOCIETY.—The monthly meeting of this Society was held on Monday, July 16th, when Mr. Thomas Brittain occupied the chair.

Mr. W. H. Peason gave a report on the hepaticæ collected by the members of the society during their excursion into Wales at Easter. Amongst the rarest found may be mentioned *Adelanthus decipiens*, first recognised in Wales by Dr. Carrington; *Riccia nigrella*, *Riccia tumida*, *Lejeunia hamatifolia*, *Lejeunia ovata*, *Radula aquilegia*, *Radula voluta*, *Lepidozia Pearsoni*, and *Plagiochila tridenticulata*. Mr. George Stabler, of Levens, sent specimens of *Lepidozia tumidula*, collected lately by him at Clougha, Lancashire. This rare species has only previously been collected in Yorkshire (Idle Woods, Dr. Carrington) and south of Ireland. He also sent for distribution from the same locality *Tetrodontium Brownianum*.

Mr. W. E. A. Axon read a paper on an Epidemic of *Tricophyton tonsurans* in France.

A packet containing specimens of the rare *Gymnostomum calcareum*, gathered in Cheedale, Derbyshire, was received from Mr. W. West, of Bradford, and distributed, with best thanks to the donor. On behalf of the honorary secretary (Mr. Rogers) and Captain Cunliffe, who were upon a moss-collecting tour in the north, it was reported that at Castleton, Derbyshire, on the 30th June last, they gathered three very rare mosses, namely, *Seligeria tristicha*, *S. pusilla*, and *Anodus Donianus*. The discovery of the first-named in that locality is somewhat remarkable. In Schimper's Synopsis (edit. 2) there is the following note under the head of "Stationes novæ Muscorum nonnullorum rariorum:" "*Seligeria tristicha*, in rupibus calcariis pr. Castleton, Angliæ (Whitehead)." Mr. Whitehead, however, disclaimed the discovery some time afterwards in the pages of the *Naturalist*. Mr. Cash mentioned the discovery of *Orthodontium gracile* by himself, in Nant-y-Ffrith, near Wrexham, in June last. The moss had fruited abundantly, but the capsules were old, and on that account only one or two tufts were gathered. This is believed to be the first time this rare moss has been reported from the Principality. In the same locality *Tetraphis pellucida* was observed fruiting freely; and the rare *Gymnostomum commutatum* was gathered.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.— The usual meeting of this Society was held on Thursday evening, August 4th, under the presidency of Dr. J. H. Worrall, J.P. A goodly number of members were present. The ordinary business of the meeting having been transacted, the examination of objects under the microscopes was proceeded with, the following list of specimens being shown:—

Spirogyra quinina	Mr. W. Burton.
Hydrodictyon utriculatum (Water Net)	Mr. Bolton.
Volvox globator	Mr. Jno. Burton.
Protococcus pluvialis	Mr. Bolton.
Pandorina morum	Mr. Jno. Burton.
Amœba diffluens Actinophrys Sol	Mr. W. Burton.
Stentor polymorphus Vorticella convallaria	Do.
Spongilla fluviatilis	Mr. Bolton.
Hydra viridis	Mr. W. Burton.
Plumatella repens	Mr. J. Astin.

Rotifer vulgaris	Mr. W. Burton.
Philodina roseola	Do.
Brachionus Bakerii	Do.
Limnia ceratophylli	Do.
Œcistes crystallinus	Do.
Melicerta Ringens	Mr. J. Astin.
Do.	Mr. Bolton.
Diatomaceæ various	Mr. J. Spence Smithson.
Do. do.	Mr. J. T. Wood.
Sections Fossil, Botany various	Do.

NOTES AND QUERIES.

Opening Meeting.—The coming winter is being foreshadowed by the announcement relating to Microscopical Societies. The Rochdale and Whitworth Society is announcing its Opening Soirée, to extend over two days, the 21st and 22nd September, on each of which evenings a Lecture will be delivered, illustrated with transparencies from the oxy-hydrogen lantern.

The Soirée will be opened by the Rev. Canon Maclure, M.A., Vicar of Rochdale, and amongst the Patrons we notice the following names:—The Earl of Derby, the Bishop of Manchester, T. B. Potter, Esq., M.P., W. Agnew, Esq., M.P., W. B. Carpenter, Esq., M.D., Lionel S. Beale, Esq., F.R.S., W. Boyd Dawkins, Esq., F.R.S, Arthur Gamgee, Esq., F.R.S., Rev. W. H. Dallinger, F.R.S., &c., &c. We heartily wish the executive every success, and in order that members of other societies wishing to be present may be able to do so, we may add that the Hon. Sec. is Mr. J. Renshaw, of 87, Drake-street, Rochdale.

Micro-fungi.—In the autumn of last year (1880) I met with two potato fields near the village of Urmston greatly infested with the common potato fungus, Perenospora infestans; this autumn I find both fields covered with what appeared to be fine crops of wheat. On careful examination I find a comparatively large proportion of the wheat infested with Tilletia caries, much more so than is usual in wheat crops. Does any physical relationship exist betwixt the two parasites?

As yet we are very much in the dark as to the life-history of micro-fungi. All students who may have opportunities of noticing any peculiar circumstance in their history should take some means of securing a permanent record of the same for further use; and I have no doubt that the Editor of The Northern Microscopist will help in the good work.—*T. Brittain.*

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

C. T. A.—No doubt your suggestion is a good one, but it would take up so much of our time that it would be impossible to carry it out.

C. H.—A translation of the paper would we fear not be of sufficient interest to our readers.

H. P.—Pasteur's solution is made of cane sugar and the ashes of yeast, and is no better than the artificial mixture of phosphates, &c.

C. E.—Aylward's turntable you will find described in this number: it is a useful article.

W. B.—We hope you will approve the article. In this form it will be of use to many.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

VEGETABLE SECTIONS. — Well-mounted double stained Vegetable Sections, in exchange for good Polarizing Objects, also well prepared. A. J., Doherty, 26, Leamington Street, Oxford Road, Manchester.

DIATOMS AND CRYSTALS.—Will exchange these for well-mounted Anatomical Preparations. A. Smith, The Laboratory, Essex Road, London.

MARINE ALGÆ.—Wanted, Marine Algæ in fructification, in exchange for well-mounted slides. J. Tempère, Storrington, Sussex.

CLUSTER CUPS.—Freshly collected specimens of these micro-fungi from the dock, sorrel, pilewort, and nettle, in exchange for king-fishers' eggs, side-blown. G. Garrett, 13, Burlington Road, Ipswich.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

POLYZOA.—Named Slides of British and Foreign Polyzoa, at six shillings and eight shillings per dozen respectively.—J. C. E., care of the EDITOR.

BINOCULAR MICROSCOPE.—A good Binocular Microscope, mechanical stage, with pair of A eyepieces and one each B, C, and D, Selenite stage, Morris' stage, Achromatic Condenser, Polariscope, Camera Lucida, double nose piece, Bull's eye condenser; in Mahogany Cabinet, with 2 and 4 inch objective. Price £13. Approval. B. D., care of Editor NORTHERN MICROSCOPIST.

IMMERSION OBJECTIVE.—A Splendid one-fifteenth Immersion Objective, as good as new. What offers? B., care of Editor NORTHERN MICROSCOPIST.

THE NORTHERN MICROSCOPIST.

No. 10. *OCTOBER.* 1881.

THE BRITISH ASSOCIATION AT YORK, SEPTEMBER, 1881.

AN "Exhibition of Instruments for scientific research illustrating the progress made in their construction during the past fifty years" was to have been an attractive feature of the Jubilee Meeting of this Association, held at York in September this year.

As the Microscope is one of those instruments which has perhaps helped as much as any other to advance our knowledge in almost every direction, we visited York in the hope of having placed before our eyes the various improvements effected during the past half century; but we must confess to having returned completely disappointed.

There surely must be a plethora of material in this country for a really good and instructive microscopical display, not only of the progress made during the past half century, but much longer, and we cannot therefore but imagine that the meagre collection (it cannot be fairly called an exhibition) of microscopes to which the visitors were treated, resulted from the management of this department being placed in the wrong hands. Microscopy now-a-days enters so largely into the composition of every method of scientific research, that every effort should be made by those in high places to build up the study upon a sound basis, and tear down the shroud of charlatanism and secrecy which unfortunately too often pervades and surrounds the microscope in many districts. Here was a grand opportunity for those who desired to show what the microscope was, and is; an exhibition visited by thousands of scientists, and a Soirée so densely packed as to be almost uncomfortable, yet had it not been for Mr. Thomas Bolton, of Newhall Street, Birmingham, who was present with several microscopes and a host of "Living Organisms," the whole microscopical department would have remained in obscurity, to say nothing of the fact that the real progress in microscope manufacture was not demonstrated by the instruments exhibited.

We had expected to find objects exhibited under the various microscopes manufactured by the leading makers during the past fifty years: the single lenses; the non-achromatic compound; Pritchard's jewel microscope; Wollaston's doublets; Tulley's achromatics; The Amician reflector; were all in limited use fifty years ago, and the same object displayed under each would have formed a starting point, from which the progress might have been judged. In 1830, Dr. Wollaston sent forth to the world his celebrated doublet, consisting of two plano-convex lenses—fifty years have passed away, the doublet is a thing of the past, and therefore the student has only on special occasions the opportunity of seeing or even hearing of these antiquated instruments.

In the Exhibition at Bootham's Bar was to be found a case of instruments lent by the Science and Art Department, Kensington Museum, containing optical apparatus chiefly of foreign manufacture, Fresnel's rhombs; Iceland spar cut in three directions, perpendicularly, parallel, and obliquely to the axis; and a polarizing microscope, with lens for parallel light and prism for measuring the axes—all made by Laurent of Paris. Norremberg's polarizing apparatus, made by Lutz of Paris, and a Refractometer on Prof. Abbe's system, made by Carl Zeiss of Jena, were also shown. In this case also was to be seen Dr. Goring's engiscope (compound achromatic microscope) which has been illustrated in Pritchard's "Microscopic Illustrations," and this was the only instrument in this exhibition giving the observer any idea of what a modern microscope was.

Wending our way to the Assembly Rooms in Blake-street, where we were informed was a Loan Museum, we entered the corridor by a few exceedingly steep and inconvenient steps, to find ourselves in the midst of a number of workmen busy in all directions removing the tinsel, the remnants of the previous night's soirée. No one seemed to know where the celebrated exhibition of scientific apparatus was being held, and the absence of any placards seemed to indicate that we were travelling in the wrong direction. We pursued our course nevertheless, and eventually found ourselves in the Concert Hall, where half-a-dozen people were wandering about evidently like ourselves on a voyage of discovery.

Upon a table or bench on one side of the room stood a microscope owned by the Rev. W. H. Dallinger, made by Messrs. Powell and Lealand, with the microscope lamp used by this observer in his researches upon "the life history of a minute septic organism." The object of this lamp is to secure minute and delicate adjustments in the position of the flame image upon the mirror or prism, since it has been found by the exhibitor that perfectly central illumination can only be secured by having the image of the flame exactly under the optical axis of the sub-stage combination, after

the latter has been made to coincide with the optical axis of the object glass. This will enable the microscopist to illuminate the whole field of a $\frac{1}{4}$-inch object glass through an aperture of 1-100th of an inch in diameter. But it can only practically be done by a fine set of mechanical motions in rectangular positions, giving perfect command of the position of the flame.

There was also exhibited an apparatus for continuous observation of minute organisms, with the highest powers, by preventing evaporation of the fluid in which the organisms live. This apparatus was devised by Messrs. Dallinger & Drysdale, for prosecuting their "Researches into the Life History of the Monads." It is used upon the ordinary mechanical stage of the microscope, so as to admit of the continuous examination under the highest powers of the same drop of a putrefactive or other fluid without allowing it to evaporate. The capillarity of the linen carries over a constant supply of moisture; part of this linen is included in a central cylinder, into which the object glass projects, and the water thus constantly carried into this air-tight chamber causes the air therein to become so saturated that evaporation from the fluid, under examination, cannot take place. The highest powers may be used, as the india-rubber diaphragm yields instantly to the screw of the "fine adjustment."

An apparatus for studying the effects of successive applications of heat to the freshly emitted spore of the septic organisms, without allowing access of air from without after hermetically sealing, was also shown by Mr. Dallinger. The instrument consists essentially of a flat round cell, with extremely thin floor and roof, and with a very narrow space between. This cell is in communication with a bulb, in which is the septic fluid suitable to the organism whose spore is being subjected to heat. The spore, just seen to be emitted from the sac under a suitable lens, is by arrangements detailed in the Proceedings of the Royal Society, inserted in the bulb; which is then subjected as a whole to the heat required, and hermetically sealed. The heating, however, drives off the air; its absence might be an injurious factor in the experiments. Hence the *second* bulb above the large one containing the fluid is so placed, that it is divided from it by a very thin septum; a piece of platinum is placed loosely in it, and it is filled with *calcined* air and closed. Hence when, by heating the septic fluid, the air is driven off, and it is closed, the calcined air in the upper bulb is introduced by shaking the piece of free platinum upon the thin septum, which breaks it, and the air it contains is diffused in the closed bulb with its cell. By placing the whole in a cradle the behaviour of the spore may be studied with high powers in the flat cell referred to.

Further on were to be seen a collection of mineral and rock

sections, exhibited by Messrs. James How & Co., of London; this firm also exhibiting a beautiful collection of lantern transparencies, chiefly geological and physiological, for the illustration of scientific lectures by means of the lantern.

On the opposite side of the room, ranged along a bench against a dead wall, stood a row of microscopes, and we immediately jumped to the conclusion that this was the promised exhibition to show the progress made in scientific instruments during the past half century. The first instrument which caught our eye was one of Beck's popular microscopes; next to this stood one of Collins' "Harley," of the old pattern, upon the stage of which was placed a specimen of Atlantic ooze, and no doubt this would have been an interesting object had there been light enough to see it; but from the manner and situation in which the instruments were placed, the observer was verily standing in his own light. A third microscope revealed itself as one of Messrs. Baker's, of Holborn, upon which was shown a section of the œsophagus of a rabbit, the tongue section of the same animal being exhibited a little further on, under one of Smith & Beck's old form of student's stand. A yard in advance of these stood one of Powell & Lealand's No. 3 stands, behind which, hanging upon the wall, were a set of photomicrographs of wood-sections, by Dr. Marshall Watts, perhaps the cleanest and best photographs of these subjects we have ever seen.

One of Ross' old stands, numbered "465," was also shown, and by the side of it, one by the same makers, but older still. The "Universal" stand of Messrs. Beck was also exhibited, alongside being one of Messrs. Powell & Lealand, carrying stays from the upper end of the body to the outer edges of the transverse arm. A form of microscope similar to that shown in fig. 44 of our Sept. number, but with the small body tube we deprecate so much, and the continental eyepiece, was exhibited, bearing the name R. Smith, York. It is astonishing how many of these instruments of precisely similar pattern are to be found in one's travels bearing local opticians' names.

Swift's "Challenge" microscope was also exhibited, and as it is an instrument specially liked by many of our friends and correspondents, we were about to examine a section of brain which appeared to be placed upon the stage, when a Mr. Haughton Gill ran hurriedly up and entreated us not to touch *that microscope* as it was fitted with "a tenth of an inch object-glass which focussed one two-hundredth of an inch from the cover-glass." We smiled at the simple-mindedness of any microscopist of experience taking, in the first place, a tenth objective to a general soirée, and secondly, in leaving it there. Most of our readers will be aware that non-microscopical observers generally rack down the objective upon the object as a preliminary to looking through the tube: the rule

seems to be, to screw down until something gives. We admired Mr. Gill's care and watchfulness of the tenth, in this instance, though there were times at which he was absent, and damage might have been done; still we did think he might have offered to show us the capabilities of this wonderful glass.

In one corner, but badly displayed, as if ashamed of their own incongruity of form, stood several old microscopes which had been lent by the Council of the Royal Microscopical Society. An engiscope of American manufacture, one of Martin's microscopes, and an old instrument made by Culpepper. A similar instrument to this last, the property of the Yorkshire Philosophical Society, was also exhibited by the side of one of Messrs. Powell and Lealand's best stands, and formed an excellent contrast, though it should be remembered that Martin and Culpepper lived before the last half-century.

At the Guildhall we noticed a placard inviting demonstrations, and there is no doubt that had the department been placed in proper hands, the microscopical display would have formed one of the most attractive features of the Jubilee Meeting, and seeing that it failed most signally to indicate the progress made in microscopical instruments during the past fifty years, an effort should have been made to substitute an attractive for an intellectual feast. As it was, the placing of the microscopes against a dead wall rendered artificial illumination necessary, even at noon-day, while had a series of tables been placed round the telescopes in the centre, sufficient illumination could have been obtained for the exhibition of most objects from the diffused light of the building. Mr. Gill seemed anxious to inform us that the instruments had been lent by his friends, and were left in his charge, but with the exception of the watchfulness bestowed on the tenth objective which focussed a two-hundredth of an inch from the object, we do not think he distinguished himself in any very great degree.

THE BACTERIA FALLACY ILLUSTRATED.

By R. R. Gregg.*

THE following cuts illustrate and expose the great bacteria fallacy, and show the three classified forms of so-called bacteria, in diphtheria, to be nothing more than the three stages in the fibrillation of fibrin, of which the diphtheritic membranes are composed.

All the membranes of diphtheria are wholly, or almost wholly, composed of fibrin.

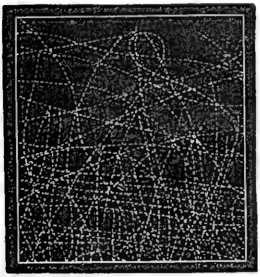
* A paper extracted by "The Microscope," U.S.A., from the Buffalo "Investigator."

This fibrin is thrown out into the throat, or upon other parts, because it is in excess in the blood in this disease.

Were such excess not expelled from the blood-vessels, every severe case of diphtheria would soon prove fatal, from the fibrillation of this superfluous fibrin into large clots in the heart or pulmonary artery, that would instantly take life, or into smaller clots that would be driven along through the aorta into smaller arteries that would arrest them, when they would cause embolism and death in that way.

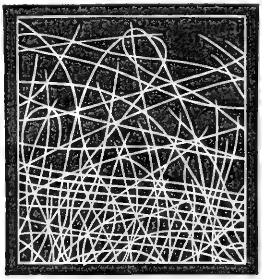
The expulsion of the excess of fibrin from the blood, upon those parts where it organises into a menbrane, is, therefore, a strictly conservative effort of nature to get such excess out of the blood and save the life of the patient, by avoiding its coagulation within the vessels, and certain death were it not expelled.

The mis-named micrococci or spherical bacteria of diphtheria.



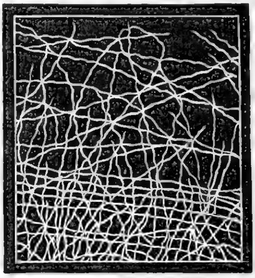
Granules of fibrin, or the first stage of its fibrillation.
Fig. 51.

The mis-named rod-like bacteria of diphtheria.



Fibrils of fibrin, or the second stage of its fibrillation.
Fig. 52.

The mis-named spiral bacteria of diphtheria.



Spirals of fibrin, or the contractive stage of its fibrils.
Fig. 53.

It is the one especial attribute of fibrin to fibrillate, whether in the clot of healthy blood, in the coagula that form in the heart or arteries from its excess in the blood, or in diphtheritic membranes. And in fibrillating it always organizes first into granules (fig. 51), then these join together into fine threads (fig. 52), which threads contract into spirals, if their ends are left free from attachments, as shown in fig. 53.

Consequently, there was never a drop of healthy blood coagulated that it did not yield these three forms of so-called bacteria—spherical, rod-like and spiral; the first two while the fibrin was organizing, and the last while the coagulum was contracting or shrinking into a smaller compass. No clot of blood could ever become smaller, as all do, but for the fibrils contracting into spirals, and thus shrivelling the whole mass.

In the heart-clot precisely the same process is carried out, the excess of fibrin organizing first into granules, and these joining into threads, and the latter contracting into spirals. And, furthermore,

the first two of these steps are taken in precisely the same way with the excess of fibrin thrown out of the blood upon any surface, where it organizes into a membrane, while all fibrils, the ends of which are left free from attachments, contract into spirals, and this gives us the so-called spiral bacteria in connection with diphtheria.

Thus it will be seen that this whole question of the membranes of diphtheria, the falsely assumed bacteria in connection therewith, the coagula of the heart in this disease, etc., may be placed at once upon a purely scientific basis, if the profession so desires. And by this showing, too, it will be seen that the exercise of a little common sense, and the proper application of a few simple facts to the solution of the subject, by the original promulgators and promoters of the bacteria theory, would have saved the medical profession a great disgrace, would have avoided hastening tens of thousands of patients out of the world in the vain effort to destroy by treatment what did not exist, as vegetable parasites, and would have rapidly advanced, instead of retarded, our knowledge of this terrible disease.

MICRO-FUNGI FOR OCTOBER.

DURING this month, and onwards during the year, the Nidulariacei may be found, and are well worth the looking for. They are not leaf-fungi of which I have hitherto spoken, but one species. *Thelebolus terrestris* may be found upon fir leaves. The dying or dead stems of ferns, especially of *Pteris aquilina*, are the habitats of many of them; others may be found on dead twigs lying on the ground, or in other similar situations. Many of them are in appearance like small birds' nests, hence the name of Nidulariacei. In one species, *Crucibulum vulgare*, there are from four to six of these egg-like bodies on an average in each nest about the size of a moderate sized pin's head. If one of these egg-like bodies be softened in water and broken up, it will be found to contain thousands of oval transparent spores. Although I have bestowed much trouble in looking for these curious plants, I have only met with a few of them. *Cyathus vernicosus* I found at Broughton in Furness in August, 1875, and *Spherobolus stellatus* in October of the same year at Marple. It will be observed that the fungi referred to are comparatively large, and may be readily recognised if the student is fortunate enough to meet with them. Some of them will measure from quarter of an inch to half an inch or more in diameter. There are many species of Ascobolus, which belong to the Elvellacei, now to be met with, and they are easily recognised. Numerous of them are of a bright orange or yellow

colour, and grow upon cow-dung. They may be found in almost every pasture where cows feed. The fruit of the Ascobolus, when well mounted, forms one of the most beautiful of microscopic objects. The spores are in countless number of pod-like cases called asci, and are very transparent. They should be mounted in jelly or fluid. After many trials, I have been compelled to give up Canada balsam as a medium for these objects.

Besides the above so easily found there are numerous other species which require carefully looking for: some are black, some green, and others of various shades. A many of them are very small. By far the larger number of the species are to be found upon the dung of animals—the cow, horse, rabbit, sheep, and others furnish numerous species. Some have been found upon leather and old rags, but I must not occupy the space necessary for a fuller account of these interesting fungi. I will only add that they may be found anywhere in the proper season. Some of the species may be met with all the year round. At the present time cow-dung is the favourite nidus upon which several species grow in great abundance.

Some of the Myxogastres (a most interesting family, and a great puzzle to the science student) come to the front about this time, while others of them are over, and will not appear again until spring. *Physarum album* is a very interesting member of the family. Damp shady places, especially woods, should be explored in search of it. It may be found on various substances. My most pleasing specimen I found on leaves of ground ivy in October of last year. Other species may be found on dead branches of trees lying on the ground or on rotten wood.

Various species of Arcyria (they also belong to the Myxogastres) may now be met with on rotten wood or on moss in damp places. They are exceedingly beautiful microscopic objects, and are comparatively common. The *Arcyria punicea*, the common name of which is "Splendid Arcyrea," does truly merit that name. It is of a rich red colour, about the size of a large pin's head, and clusters of the fungus are usually found together. There are other members of the family that will be met with by the diligent student, but I name this one specially, as it is of all of them the most easily found in consequence of its bright colour.

The Trichia (also Myxogastres) are now to be met with. They also are found on rotten wood. One of them, *Trichia rubiformis*, is readily seen by its bright red colour, and is here known commonly as "Reddish Trichia." There are numerous species of the Trichia, almost all on rotten wood. During the month, and indeed during the winter, the forest, where dead sticks are scattered about, and dead stumps, in various conditions of rottenness may be met with, forms a rich hunting ground for the student. Not only are

the above rich in minute fungi, but the thousands of leaves spread about under his feet are almost all more or less covered with minute cryptograms. I have rambled miles amongst such scenes of dead vegetation, where I have found an infinity of life springing up from the ashes of the dead. Organisms, wonderful in their structure, rich in colour, and when seen under the lens of a good microscope, as beautiful as the loved flowers of the spring. The admirer of the common wild flowers finds his special botanical enjoyment gone as winter approaches, but it is not so with the microscopist; for him nature provides a perpetual feast. No frost or storm can deprive him of his plants. The enjoyment he has when he meets with them is untold, and in due time they are placed in his cabinet, and become things of beauty for ever.

I have once met with *Xenodochus carbonarius* as late as October, as also various members of the same genus; indeed, there are a goodly number of leaf-fungi still to be found. Sheltered warm corners amongst rocks are likely places to find late specimens of micro-fungi; indeed, the thoughtful student will not overlook such promising localities. I abstain from giving a technical description of the fungi I have referred to, as I believe the small space I can occupy is better employed in indicating to the student what to look for, and the most likely places to find what he wants. Structure is best understood by personal examination with a microscope.

I will close this paper by a reference to the Diachæa. The one species—for there is but one—belongs to the Myxogastres, and may be found when the special conditions exist all the year round. It is not so common as the other fungi I have spoken of. It grows in small tufts aggregated, and about the size of the Arcyria, but there is no beauty of colour to attract the eye, for it is perfectly black. The structure of the fungus is very beautiful, and very similar to the structure to the Arcyria. I have found this fungus but once, and that was some years ago, in a cucumber frame, upon a bit of very rotten wood. The fungus I am inclined to think is not very rare, but its blackness and small size prevent its being seen.

THOMAS BRITTAIN.

THE MOUNTING OF MOSSES FOR THE MICROSCOPE.*

ALL who have seen the slides put up by Captain P. G. Cunliffe of the Manchester Cryptogamic Society, will admit that they are beautiful specimens of manipulative skill in the art of mounting mosses.

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* A paper read before the Manchester Microscopical Society, Sept. 1st, 1881.

The secret of Mr. Cunliffe's success as a mounter, is, that his first attempts were based upon an artistic and intelligent idea of what perfect mounts should be; and if all mounters of microscopic objects would follow out a similar conception, and bestow anything like attention to details and the same intelligent care in carrying out their ideas, something more like uniform excellence would be the result.

It is generally supposed Mr. Cunliffe makes a secret of his process. I do not think so. It is not so much the process as the hand which does the work upon which depends the result. What the novice fails to understand, and is unequal to, and what the successful operator has a difficulty in explaining, is, how to act under varying circumstances, and how to overcome numerous hitches which may, or may not occur.

It is easy enough to say, "Oh, wash your specimen, place it on a glass slip, add glycerine jelly, then put on your cover-glass and clip and finish by ringing in the usual manner." Good slides, however, are not the result of primitive efforts backed by such meagre information. I will endeavour then to explain, in detail, a process of which the preceding direction is only an outline.

Suppose we start with that small and pretty moss, *Dicranum heteromallum.*

The chief beauty in this moss lies principally in the capsule, and I may here remark that mosses for mounting should be in fruit, and what is more, ripe. The peristome of *Dicranum heteromallum* is a very charming object, we must therefore try and show this to advantage and preserve the capsule uninjured. In its natural state when growing and quite ripe, the calyptra and operculum are thrown off, the peristome unfolds itself and the spores issue from the capsule, and either fall to the ground or are scattered by the wind. All this should be borne in mind whilst mounting mosses, and if you can show the spores leaving the capsule, and also the calyptra and operculum, so much the better.

How is all this done? If you have sufficient material, select enough for several mounts. Let your selections be as perfect and as free from dirt as possible. Moss-gatherers should always carry and keep specimens as uncontaminated with dust and dirt as they possibly can.

Gently shake and remove, with the aid of a small sable brush, as much dirt, dust, and grit as you can; then place your specimens in clean water, and shortly the leaves will expand and look as fresh and green as when growing. Use your brush and move them carefully and quickly about in the water to further cleanse them: transfer to small bottle of water again and shake carefully. Change the water, and repeat if necessary.

During the washing process the operculi will probably fall from

the capsules, therefore keep a look out. Occasionally they will have to be carefully dislodged. If the peristomes are open to commence with, an operculum may be found perhaps washed from amongst the leaves.

After taking from the bottle, examine your specimens and remove ragged and imperfect portions, if any; place on a slip and see if clean with a low power of your microscope. If so, you will be lucky. Most probably you will find it necessary to use the brush again, holding the moss under water with one brush whilst you clean with another. You can try placing your specimens in a saucer and letting the water tap drop on them. When you have succeeded in getting them clean, have your glycerine jelly ready. Now arrange your moss on a slip, unfold and spread out the leaves gracefully and naturally, and with the capsules placed with an eye to artistic effect as if growing. Put three small beads or portions of broken glass circles for the edges of your cover glass to rest evenly upon, so as not to rest upon and burst the capsules, and to prevent tilting; put on your cover glass and secure with wire clip; drop the glycerine jelly round the edge of the cover and it will run under. Now gently heat over a spirit lamp until ebullition takes place. This operation requires a little practice, but when successfully done it drives out all air bubbles, liberates a few spores from the capsule, and makes the leaves more transparent for examination. Should the spores leave the capsule in excess, and cloud the field, transfer to clean slip and repeat the experiment.

Good glycerine jelly will set immediately, when you may possibly find the boiling has interfered a little with the nice (that is, natural) position of some of the leaves and capsules. If so, warm the slide until the jelly is in a fluid state, insert a needle under the cover and replace all straight; at the same time and by the same means push under and place in position the operculi.

Occasionally there may be a desire to preserve intact the beautiful fresh green tint of the leaves. In that case, after you have got your moss satisfactorily clean, you will have to soak in glycerine for several weeks until the glycerine has thoroughly permeated and driven out all air from the capsules and leaves.

When ready, place a warm slip on your mounting stage, put your specimen of moss in the centre, and with the aid of a lens arrange as straightly as possible; seeing at the same time any air bubbles are dislodged either with a needle point or gentle pressure of some kind. Now apply the glycerine jelly, dip your cover glass in warm water, put over all and gently press down. In adopting this method you are not very sure of keeping the moss as artistically displayed as you could wish, but the judicious use of a needle, quickly handled before the jelly sets, will put right any serious defect. Ring and finish as with other slides.

These few instructions, with now and then a few slight modifications, which will readily occur to a quick-witted operator, should enable any one of average capacity and skill to mount mosses respectably, though they may not attain the same degree of perfection as Captain Cunliffe.

J. L. W. MILES.

THE BEE'S TONGUE AND GLANDS CONNECTED WITH IT.*

BY JUSTIN SPAULDING.

THE present paper is the outcome of an interest in the subject, awakened by an article, by Mr. J. D. Hyatt, on the sting of the honey bee, in the *American Quarterly Microscopical Journal* for October, 1878, followed by one on the structure of the tongue by the same author, in July, 1879. Both bear the impress of careful and painstaking interpretation of facts, and a genius in manipulation that is truly marvellous. Mr. Chambers' article, published previously to Mr. Hyatt's, and which he criticises, I have not seen, and am indebted to Mr. Hyatt for what knowledge I possess of it. His article on the bee's sting incited me to attempt to demonstrate for myself if it was indeed the marvellous little structure described, and I can add my testimony to the literal accuracy of description, drawing, and, as I believe, of his interpretation of the bee's manner of working it.

My own observation, so far as the ligula is concerned, agrees with Prof. Cook's (see *Naturalist*, April, 1880), and I think he has given the true solution when he says it consists of a sheath, slit below, within which is the grooved rod, and, projecting from the edges of the latter to the edges of the sheath, is a thin membrane, forming, as will be easily understood, when the rod is extended or thrown down, an enclosed sac, open only at the top.

In going over the work of Mr. Hyatt, while examining a mounted specimen of mouth parts, my friend, Mr. F. B. Doten, pointed out in the mentum, a small spiral tube that gave me a clue, which, followed up, has resulted, as I believe, in a slight addition to our knowledge of the parts.

Running the scalpel from the base of one mandible back, across, close to the neck and forward to the other mandible, remove the brain and salivary glands; cut the œsophagus as far forward as possible, turn it back, and if all has been done carefully, one sees

* Abstract from the *American Naturalist*, with additions, by the *American Monthly Microscopical Journal.*

coming from the thorax the spiral ducts of two glands, which will be found, on following back, lying one on each side of the œsophagus, in the space between the muscles of the wings.

At the base, the duct enlarges into quite a reservoir. The ducts unite within the neck, or just as they enter the head, and following the floor of the latter, are joined by a pair coming in right and left. Following up one of these side glands, we find it dividing into three main branches, ultimately terminating in glands; the glands from the thorax bear a striking resemblance to the Malpighian tubules of insects, while those from the head are larger, different in shape, and composed of much smaller cells. Keeping to the floor of the head, the main duct passes on to the sub-mentum. Here, on joining the spiral tube coming from the ligula, it passes by an opening common to both into the mouth. Below the opening the spiral tube dips into the mentum and is imbedded in its muscles.

A series of cross sections shows it to gradually widen to near the base of the ligula, where it terminates in a chamber that leads above into the sac, and below by a valvular opening into the groove in the rod.

Thus we have a passage from the tip of the ligula through the groove in the rod, and the spiral tube in the mentum to the opening in front of the pharynx, above the labium and between the mandibles. This opening is transverse, and seems to have lips, and from its appearance we should expect it to close like a valve, if suction was applied below.

Meeting this tube from the ligula, and discharging its contents through the same opening into the mouth, is the spiral duct from the glands of the head and thorax.

The questions are at once thrust upon us, whence comes this structure? and of what use is it to the bee? If I were wise the article would end here; but our inclination to explain everything by resorting to speculation, is always strong, in the absence of facts to curb it. It seems but natural from the size, position, and outlet of the glands, connected as they are with an inlet for the nectar of flowers, to conclude that they are organs that furnish the animal secretion that changes nectar into honey, and I would venture the suggestion that they may be the spinning glands of the larvæ modified. If this is true, I should expect to find them either in an active or aborted condition in nearly all Hymenoptera.

Another question raised is, in what way is nectar carried from the flower to the mouth? This must be, from the nature of the case, largely a matter of speculation. Prof. Cook, in his article, says, "The tongue is also retracted and extended rythmically while the bee is sipping." May not this motion be due to a pumping action of the grooved rod of the ligula, that enlarges and diminishes

the size of the sac lying behind it? It would seem that the bee has perfect control of this rod, that it is remarkably elastic, and capable of much extension and contraction; the rod and sac thus acting as a suction and force pump, as will be easily understood by one familiar with the parts.

Of course I cannot say that the bee makes this use of it, but I do say it should, and if it does not, it is pure stupidity on its part. And if some one demonstrates that I am all wrong now, evolution at no distant day will set me right, for there will be born a bee, less conservative, that will dare defy old usages, and take a new departure; that bee, trust me, will make use of this cunningly-devised apparatus, and produce honey cheaper than any competitor, excepting the glucose man, and I hope and trust may worry even him.

[Many celebrated entomologists, especially Europeans, assert that the tongue of the bee is solid, and essentially a "lapping" organ. Others, with equal confidence, pronounce it a "hollow sucking tube." Whatever may be the true construction of the tongue, one fact is certain and easy of demonstration, viz.: bees both suck and lap their food. To show this, first attract the bees by exposing some honey in an open vessel, and, having secured their attention, remove the dish, and substitute in its place a pane of glass with a single small drop of honey upon it. Invert the glass so as to observe the bees from the upper side. At first they will be seen to insert the ends of their tongues into the drop, and suck with the pulsating motion of abdomen and tongue referred to by Cook (p. 118). Then, as soon as the supply of honey is so far exhausted that sucking is impracticable, they may be readily seen to lap up the remainder, wiping their long tongues, fully extended, over the glass until every particle of it is secured.

In Mr. Hyatt's article in the *Quarterly*, he doubts whether there is any connecting membrane, but that such a membrane does really exist, may be seen by killing a bee while in the act of sucking, and carefully pressing the thorax when the rod will be thrown out, and the membrane disclosed to the naked eye. Owing to its extreme thinness and delicacy, however, it is next to impossible to show it in a mounted specimen. Mr. Folsom's section was made from the tongue of a bee which died naturally with the rod out, and required no manipulation.—JOHN D. WHITE.]

OUR BOOK SHELF.

Portfolio of Drawings and Descriptions of Living Organisms sent out by THOMAS BOLTON, F.R.M.S., 57, Newhall-street, Birmingham. No. 5.

This Portfolio, issued at the moderate price of One Shilling, should find its way into the hands of all students. It contains drawings of—

VEGETABLE KINGDOM.

Bacillaria paradoxa.

ANIMAL KINGDOM.

Triloculina trigonula.	*Œcistes longipes* and *pilula.*
Noctiluca miliaris.	*Œcistes Janus.*
Raphidomonas semen.	*Conochilus volvox.*
Epistylis plicatilis.	*Rotifer macrurus.*
Vaginicola, &c.	*Daphnia pulex.*
Clytia Johnstoni.	Larval shrimp.
Medusiform gonozoid.	*Fredericella sultana.*
Cercaria (Larval Fluke).	*Bugula turbinata.*

Most of the tubes sent out by Mr. Bolton during the past three months have been specially interesting: we therefore regret to hear of a decrease in his list of subscribers.

NORTHERN SOCIETIES.

BOLTON MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER NATURAL SCIENCE ASSOCIATION. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LINCOLN. Hon. Sec. : Mr. R. J. Ward.

LIVERPOOL MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER CRYPTOGAMIC SOCIETY. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER SCIENCE ASSOCIATION. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. NORTH OF ENGLAND MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM MICROSCOPICAL SOCIETY. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. Hon. Sec., Mr. B. W. Wood. Meets on the First and Third Friday in each month.

NOTICES OF MEETINGS.

MANCHESTER CRYPTOGAMIC SOCIETY.—The usual monthly meeting of this Society was held on Monday, August 15th, Captain Cunliffe, F.R.M.S., occupied the chair, in the absence of Dr. Carrington, President, whose continued illness still prevents him attending the meetings. The members are now glad to learn that he is in a fair way of recovery from a long and painful illness.

A number of mosses which had been collected during the late excursion to the Grampian and Breadalbane mountains were exhibited. *Arctoa fulvella* and *Œdipodium Griffithianum* from Ben Cruachan. The latter-named rare species was found fruiting abundantly. *Leskea rufescens* was found frequently in fruit on Ben Laoigh and other mountains. *Hypnum crista-castrensis*, *Dissodon splachnoides*, and *Bryum alpinum* were exhibited in fruiting condition, having been found in good quantity in the neighbourhood of Loch Tay.

A tuft of *Tetraplodon mnioides* taken from a large patch found growing on the dead body of a mountain hare on Meal Farmechan, was exhibited. This species is one of a small group of mosses which are always found on the dung of animals, or some decaying animal substance. In the present case the body of the hare had become quite disentegrated ; in fact nothing could be seen but a few small bones and the fur of the animal, into which the roots of the moss had been completely felted, presenting a singular appearance, and containing thousands of capsules. Most of the species exhibited had been mounted on microscopic slides, so that the mosses were seen as they appeared when growing, and also displayed for observing microscopic characters. Mr. Cunliffe also distributed specimens of *Fissidens polyphyllus*, and exhibited *Splachnum ampullaceum* which he had recently collected in North Wales.

Mr. W. H. Pearson announced having found two new stations for the rare *Jung. myriocarpa* (Carr.) in company of Mr. Geo. Stabler, on Langdale, Westmoreland, and on Clogwyn due Arddu, North Wales, August, 1881. This very distinct species which Dr. Spruce characterises as the happiest discovery of our President, was first found on Ben Venue, 1876. It has also been found lately in Italy by Prof. Massalongo. Amongst the Westmoreland and Welsh specimens the male plants were found, which hitherto had not been observed.

The thanks of the Society were given to the Council of the Royal Microscopical Society for a copy of their proceedings, and also to Mr. J. Cash, one of the active members of the Society, for two sets of moss labels which he has recently published. They are arranged after the London Catalogue, and are certainly a desideratum for those who keep a bryological herbarium.

MANCHESTER MICROSCOPICAL SOCIETY.—The ordinary monthly meeting was held on Thursday evening week, the president, Mr. John Boyd, in the chair. There was a good attendance of members. With the assistance of the Honorary Secretary, Mr. Brittain, vice-president, distributed to members present specimens of a leaf fungus found by him in July upon the bank of the river Mersey at Didsbury. The fungus is called Uromyces intrusa, and grows upon the well-known ladies' mantle, Alchemilla vulgaris. Mr. Brittain also submitted two specimens of dendritic spots for the inspection of the members, and requested an opinion upon them. These curious fungus-like looking objects were found upon old paper in a lawyer's office. Such have been frequently met with. Some students affirm they are truly fungoid; others assert they are the result of chemical or electric action, but their position in nature has not hitherto been demonstrated.

Mr. C. J. Jones exhibited the larva of the *Cossus ligniperda* (Goat Moth) captured at Thames Ditton, Surrey. The specimen measured in length three and a half inches, which length it attains after three years larval existence. It

gnaws the trunks of the elm, willow, and oak, and by excavating large galleries in those trees it often destroys some of the largest. It makes a cocoon of the dust from the gnawing of the wood, which it fastens together with a viscous secretion and then lines it with soft silk. It is the only variety to be found in this country.

Mr. Alexander Hay, of the Salford Royal Hospital, distributed specimens of *Coleosporium tussilaginis*—coltsfoot rust. Anyone may make himself acquainted with the genus Coleosporium with but little trouble, which the acquisition will more than compensate. A summer stroll into any locality in which the common coltsfoot can be found will be certain to prove sufficient. When the well-known leaves are found, the under surface of the first leaf will doubtless give proof of the presence of the fungus in question by the orange spores amongst its dense woolly hairs.

The President exhibited for the inspection of the members Mr. Saville Kent's beautiful drawings of the parasites on the Vorticellæ.

Mr. J. L. W. Miles read a paper on the Microscope and Practical Work, written chiefly for the information of the younger students in microscopy.

The paper further described the writer's method of mounting mosses, and was illustrated by diagrams and prepared slides. A discussion followed, in which the President, Messrs. Brittain, Davis, Pettigrew, Aylward, Stanley, and Lean took part. The usual conversazione followed, when the following objects were exhibited:—

A young specimen of the Rose Brittle Star (Ophiocoma rosula), showing the ambulatory hooks, or claws, *in situ*	Mr. Herbert C. Chadwick.
Aulacodiscus and Heliopelta	Mr. Alston.
Foraminifera from Lough Foyle and Polycistina from Barbadoes	Mr. A. J. Doherty.
Wood sections, palate of slug	Mr. R. L. Mestayer.
Larva of *Cossus ligniperda*	Mr. C. J. Jones.
Dendritic spots and *Tilletia caries*	Mr. T. Brittain.

MOUNTING CLASS.—The closing meeting of the Manchester Microscopical Society's mounting class was recently held in their meeting room at the Mechanics' Institution. Tea was provided for the members, and after tea the chair was occupied by the President of the society, Mr. John Boyd. The Secretary read the report, giving the origin, the formation, and, as a result, details of the work of the class during the winter and spring sessions. In moving the adoption of the report and balance-sheet, the President showed the great advantages the class afforded to beginners in the study of microscopy, especially when the carrying on of the various stages of dissecting, mounting, and displaying objects was superintended, and, where necessary, practically illustrated by "old hands." Again, the absence of formality at the meetings had tended greatly to remove the diffidence among the younger members, who were thus encouraged to come forward, enumerating their failures and stating their wants. He thought that an exhibition of Failures at one of the society's meetings would be an interesting display. A cordial vote of thanks was unanimously accorded to Mr. Miles for his work in connection with the formation and carrying on of the class; and Messrs. Chaffers, Furnival, Mestayer, and Miles were thanked for their kindness in directing the studies of the members. On the motion of Messrs. Lean and Cook, it was resolved that the next session should begin in October. Specimens of the past winter's work were then exhibited by the aid of nine microscopes. Most of the work was very creditable. The principal objects exhibited were collections of wild flowers, zoophytes, algæ, and ferns, all mounted for microscopical investigation, various slides illustrating the anatomy of the caterpillar, living specimens of *Melicerta ringens*, zoophytes and diamond beetles, Damar finished rings, transverse section of jaw

of mole, and longitudinal section of jaw of cat, both showing teeth *in situ*, Australian zoophytes, mounted as opaque and transparent objects, selected specimens of Foraminifera from Ireland, injected animal tissues and stained wood sections.

MANCHESTER SCIENCE ASSOCIATION.—At the meeting held in the Memorial Hall, Albert Square, Tuesday, August 23rd, the President occupying the chair, Mr. E. Napper, F.C.S. read an interesting paper on Yeast (Torula cerevisiæ), in which he stated that "In Literary culture the student is dependent on books; in Scientific study on the other hand he *should study nature*,—get his facts first hand, then know them thoroughly and precisely." If in this spirit we approach the study of this, one of the most simple forms of life, we may become acquainted with some of the fundamental phenomena of life. The ancients failed to understand many of the facts of nature which are easy to us; not from a want of intellectual power, but because of the imperfection of their instruments. Yet they might have learnt that yeast was a brown fluid, that it had the power of exciting fermentation in substances containing sugar, viz., wine, wort, etc. The sugar in solution being resolved into alcohol, and carbonic acid; and they might have performed many experiments to show that this power may be destroyed by exposing it to a high temperature, that the particles are diffused through the air.

Let us now see what the microscope will tell us. It was first used by Leenwenhoek. He found a number of globular bodies floating in the liquid; he did not know what they were, but was struck by their regular arrangement. Later, Caignard de la Tour found that these bodies had a definite form, and were associated in various ways. Size, from 2 to 7-1000 in., average 1-3000 in. Shape, well defined cell or vesicle, containing a nucleus and some granules. The cell is termed the sac and the contents of the sac, protoplasm; by treating with Magenta or Iodine the protoplasm is stained, but the sac is *not*. Caustic alkalies dissolve the protoplasm, but not the sac. Dilute Sulph. Acid, the sac is dissolved, but not the protoplasm; their chemical constituents therefore differ.

The Torula lives, and is a plant. Between plants and animals it is difficult to draw a line; but in the Torula the protoplasm is contained in a cellulose sac, which is characteristic of plants. The power of manufacturing Protein compounds out of simple substances is characteristic of plants. Animals consume Protein and destroy it. Plants are generally green, the Torula is colourless, it gives off $C\,O_2$ and absorbs O, requires no sunlight to aid its development. The last three characters belong to Fungi, therefore the Yeast-plant is considered a Fungus.

A number of slides were shown, descriptive of the above-mentioned characters, and Mr. Napper remarked that it surprised him, that the young microscopist did not devote some of his earlier hours in examining more of these easily obtainable, and deeply instructive lessons from nature.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.—On Thursday, August 11th, the members of this Society had their usual Micro-hunting Excursion, the weather proving unpropitious; only a limited number put in an appearance.

The party took train to Park Bridge Station, near Ashton, whence (under the guidance of Mr. W. Burton) they wended their way to Fairbottom, the termination of a branch of the Hollinwood Canal, near which some pools notorious to microscopists in the district were visited. Subsequently, they went along the Canal side to Daisy Nook, and afterwards to the Hollinwood Canal where some very good finds were made. This is a favourite spot for *Plumatella repens*, *Melicerta ringens*, *Hydra fusca*, and *Spongilla fluviatilis*.

NOTES AND QUERIES.

MR. BOLTON'S STUDIO.—Now that the long winter evenings are approaching and microscopists can no longer roam abroad in search of organisms, we would advise a closer acquaintance with the denizens of this studio. In jars, aquaria, wine glasses, bottles, &c., at 57, Newhall, Birmingham, may be found *Lophopus crystallinus*, *Cristatella mucedo*, *Plumatella repens*, *Stephanocerus Eichhornii*, and many others, ready to be sent away at a moment's notice.

HOW TO COLLECT THE ORGANISMS FROM TOWN WATER.—Make a small bag of fine cloth about 3 inches in diameter and six inches long, open at both ends. Attach the lower end to the neck of a small wide mouth bottle and the upper end to the tap of the water supply. Let the water run for an hour or more, when the organisms will be found in the bottle, from whence they may be taken for examination.

FULL SIZED BODIES.—The student will do well to consider what advantage (if any) is gained by the purchase of a microscope with a tube of small diameter. The dealer has said more than once that such microscopes as illustrated on p. 216 could be cheaply made *if there were a demand for them.* This is hardly a correct view of the case; there are very obvious reasons why these small tubes continue to be made, and in order to aid those who may wish to purchase a full size body at the ordinary price we shall be glad to put our readers in communication with a maker who will take the following sizes as his standard :—

Inside diameter of draw-tube to admit eyepieces... 1.3 inches.
Inside diameter of substage fitting 1.5 inches full.

When made to the above standards, the eyepieces and accessories of any maker may be used. If an adapter be required, it may easily be constructed of paper or cardboard. If microscopists would buy a large tube and manufacture their own adapters they would be doing more to bring about a universal guage for eyepieces and substage fittings than they on first thought imagine.

COLLIN'S HISTOLOGICAL MICROSCOPE.—Mr. Collins writes: "I have to thank you for naming my Histological microscope in your Journal for this month; but wish to point out that it has the advantages you mention. The body is capable of receiving the full-size eyepieces and apparatus of my largest microscopes."

NOTE.—When writing the article on page 215 we had overlooked the fact that the above microscope was possessed of a full-sized body. We regret this the more as the Histological stand would have been brought prominently into notice, wishing as we do to

bring about a universal guage for eyepieces and stage-fittings, and to discourage the purchase of stands with small tubes. Mr. Collins' microscope sells for £5 10s. 0d., in a mahogany cabinet, with a one-inch objective, a quarter-inch and an A eyepiece.

Sheffield Microscopical Society.—At a recent meeting of the above Society Mr. Ellis gave a very instructive paper on the "Human Eye," in which he described fully the physiological structure and names of the different parts of the eye, the diseases to which the eye is subject, the causes of such diseases, and the remedies by which some are cured. He explained the different theories for the means of focussing the eye, so as to see near and far off objects; the cause of bad eyesight and the kind of glasses to use for the same. Mr. Ellis illustrated his paper by a number of drawings and several eyes and portions of eyes.

A New Polarising Prism.—Professor S. P. Thompson read a paper at the British Association meeting, in which he said that he had tried to improve upon Nicoll's prism by cutting Iceland spar, so that the reflecting film has a principal plane of section, and thus he obtained a wider angle of aperture, so desirable for microscopic work, and abolished the blue band which interferes with the clearness of the field of vision.

Yellow Fever.—M. Pasteur has resolved to visit the Bordeaux lazaretto to study yellow fever, and ascertain whether it is due to a parasite, and can be guarded against by inoculation.

Manchester Natural History Society.—At a recent meeting of this Society several interesting communications were made. The Chairman (Mr. W. Chaffers) exhibited some micro-photographs which had been taken by Mr. Furnival, there being amongst them the tongue and eye of a fly, a human artery, showing transverse and longitudinal sections, and a number of grouped diatoms. Mr. Robert Parkes showed, by means of the microscope, a variety of beautiful organisms illustrating pond-life, both animal and vegetable. Some of the specimens shown were the *Plumatella repens*, *Vorticella nebulifera*, *Nitella*, and *Volvox globator*, the latter being so abundant as to give a green hue to the water. Mr. Thomas Rogers contributed a large grasshopper and two species of Cicads from New Orleans, and from the island of St. Thomas a fine specimen of the urchin fish *(Diodon hystrix)*.

Organisms of Nitrification.—A communication made by Mr. Warington to the British Association related to what chemists call the origin of nitrification, or the transformation of nitrogenous matter, such as sewage and animal matter, into nitrates in the soil. The result of Mr. Warington's investigations is to show that the

transformation is connected with some organism. The organism is identified as belonging to the order of bacteria. This is a supplement to the recent researches of M. Pasteur, and a discovery consolatory and gratifying, inasmuch as it supplies an instance of bacteria associated, not with disease, but with the most valuable transformations taking place in the soil. The practical value of the discovery is due to the knowledge it gives as to the transformation of nitrogenous matter into nitrates—a transformation which it must undergo before the plant can use it.

Carlisle Microscopical Society.—Meeting on Sept. 2nd. There was only a thin attendance, a great many members being away from home. The President announced some rules for conducting the ordinary meetings of the Society, and the Secretary read the proposed programme for the Session, commencing in November. These were agreed to. Pond and river water being the evening's subject, was fairly illustrated.

Loss of Light.—Refracted light through lenses causes a loss of original light fully 20 per cent., while by reflected light from the surface of mirrors only about 35 per cent. of the original light is utilised. By a combination of refracted and reflected light, which may be obtained by the use of a prism, 96 per cent. of the light which falls upon such prism may, however, be utilised. Professor Amici's illuminator is an adaptation of this principle; all light falling upon the inner surface of the hypothenuse of a glass prism of 45° being totally reflected. Four per cent. of the original light is, however, absorbed by the other two surfaces, and 96 per cent. therefore is utilised.

Mounting without pressure.—Could any of the readers of the Northern Microscopist give me particulars of the process by which the heads of bees, beetles, &c., are rendered sufficiently transparent to enable their internal structure to be exhibited when mounted without pressure?—*F. P.*

Death of the Alford Botanist.—The death is announced of John Duncan, the Alford Botanist, for whom public subscriptions were raised some months ago, amongst the subscribers being her Majesty the Queen. Duncan, who was a weaver, gathered in the course of his long life a complete collection of the grasses, &c., indigenous to Scotland. This collection he presented to the Aberdeen University in December last.

An interesting dip.—We have lately received from Mr. Thomas Bolton one of the most interesting tubes he has for a long time sent out. Professedly a tube of *Bacillaria paradoxa* of which it contained fine specimens; there were also *Nitzschia sigmoidea*,

N. lanceolata, *Grammatophora marina*, *Amphiprora alata*, *Pinnularia radiosa*, *P. viridis* together with several Amœba.

North of England Microscopical Society.—The second out-door meeting of this Society was held by the kind permission of Sir Henry A. Clavering, Bart., at Axwell Park, on the afternoon of Friday, July 13th. The margin of the lake affords a fine hunting ground for the microscopist and entomologist, the dense masses of aquatic vegetation affording shelter to innumerable organisms of the highest interest. The water lilies (*Nymphea alba*) grow in conspicuous patches and are now blooming luxuriantly—*Equisetum*, *Chara*, *Myriophyllum*, *Callitriche*—the burr reed (*Spargnium zamosum*), and many other plants of botanical interest present themselves abundantly.

Microscopic Cabinets.—We have been recently informed that Mr. Hembry, of 16, Newgate Street, London, has imported some curious cabinets from Japan of camphor wood, and has had them fitted up for the storing of microscopic objects in flat trays in three drawers, holding about 450 objects, leaving them in two little cupboards and one large bottom drawer ample room for all kinds of cements, tools, brushes, and media for mounting; in fact it becomes a microscopic and mounting cabinet. The price is, we believe, £2 15s. 0d. The outline of the above described cabinets are fashioned to represent the Fusiama or Hog Mountain of Japan.

The Formation of Vegetable Mould.—A new work by Mr. Charles Darwin will appear early in October. Its subject is the formation of vegetable mould through the action of worms, and the book will also contain some observations on the habits of worms.

The Inoculation of Vines.—The science to which M. Pasteur has devoted his studies and experiments with so much success appears likely to receive a new development. At a recent meeting of the Academy of Sciences in Paris, a communication was read from a gentleman who announced that he had discovered a mode of inoculating vines as a protection against the attacks of the phylloxera.

Wood Sections.—In our next number we hope to present our readers with a chromo-lithograph of a series of wood sections (double-stained) which Messrs. West, Newman, & Co., are preparing for the Editor's forthcoming work on Practical Microscopy.

Animal Inoculation.—The Local Government Board are circulating amongst local authorities copies of a letter addressed to

the President of that department, by the Secretary of the International Medical Congress lately held in London, drawing his attention to an address delivered by Professor Pasteur, of Paris, relative to the germ theory in connection with the inoculation of animals, as a means of protecting them against virulent diseases. In that address M. Pasteur says they lose in France, every year, by splenic fever, animals to the value of 20,000,000f. He then gives the result of an experiment he had been requested to make at a town in France. Fifty sheep were placed at his disposal, of which twenty-five were vaccinated, and the remainder underwent no treatment. A fortnight afterwards, the fifty sheep were inoculated with the most virulent anthracoid microbe. The twenty-five which had been vaccinated resisted the infection, whilst the twenty-five unvaccinated died of splenic fever within fifty hours. Since that time the capabilities of his laboratory have been inadequate to meet the demand of farmers for a supply of this vaccine. In the space of fifteen days they vaccinated in the departments surrounding Paris more than 20,000 sheep, besides a large number of cattle and horses. M. Pasteur says: "I cannot conclude this address without expressing the great pleasure I feel at the thought that it is as a member of an international medical congress assembled in England that I make known the most recent results of vaccination upon a disease more terrible perhaps to domestic animals than smallpox is to man."

THE BRITISH BEE-KEEPER'S ASSOCIATION AT SOUTH KENSINGTON.—For the best microscopic slides illustrating the natural history of the honey bee, Mr. F. Enock most deservedly carried off the silver medal. The slides were four dozen in number, and if not unapproachable are certainly as yet unapproached. The preparation of parts *in situ* without pressure gives an opportunity of examining structure that flattened chitin could never afford. The beauty of these objects when properly illuminated must be seen to be appreciated. On some slides he brings side by side the homologous parts of drone, worker, and queen, which gives a ready means of comparison, and on others displays the parts illustrative of the complete anatomy of the insect. Some clever sections and some specimens of the interesting parasite Stylops Spenceri were included in the collection.—*Journal of Horticulture.*

INSECTS MOUNTED WITHOUT PRESSURE.—We have just received a splendid specimen of the preparer's art from Mr. Fred. Enock, a bee's head mounted without pressure, and is a beautiful as well as an instructive object when properly illuminated. We wish the preparer every success as he is endeavouring to improve upon the *wretched squashed skins* so often offered for sale under the names of insects.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

C. A. L.—The small black spots upon the bramble leaf, are composed of *Phragmidium bulbosum*, while the ochraceous yellow spots are the Uredo spores of the same fungus. We cannot discover any fungus upon the oak leaf.

G. C. C.—The fungus is *Stachybotrys atra;* it is not rare in the habitat you mention. We have often found it upon mildewed cotton goods, and therefore should expect to find it upon mildewed *linen.*

W. W.—We cannot tell you where to get a good half-inch *cheap.* Try Wray, Laurel House, Highgate.

J. C. P.—We cannot undertake to send replies by post, though we are always anxious to help our readers *in these columns.*

B. C. W.—In our next number. Thanks for the slides, they are very well displayed.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free.* They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

PARASITES.—Tick of Dog, Sheep, and Horse; one of each sent for a good mounted slide. Alfred Tozer, Jackson's Row, Manchester.

DIATOMS AND CRYSTALS.—Will exchange these for well-mounted Anatomical Preparations. A. Smith, The Laboratory, Essex Road, London.

CLUSTER CUPS.—Freshly collected specimens of these micro-fungi from the dock, sorrel, pilewort, and nettle, in exchange for king-fishers' eggs, side-blown. G. Garrett, 13, Burlington Road, Ipswich.

MOSSES.—Wanted to exchange a few mosses, hepaticæ and lichens. J. McAndrew, New Galloway, N.B.

DIATOMS.—*Synedra ulna* well mounted for others. G. H. Bryan, Trumpington-road, Cambridge.

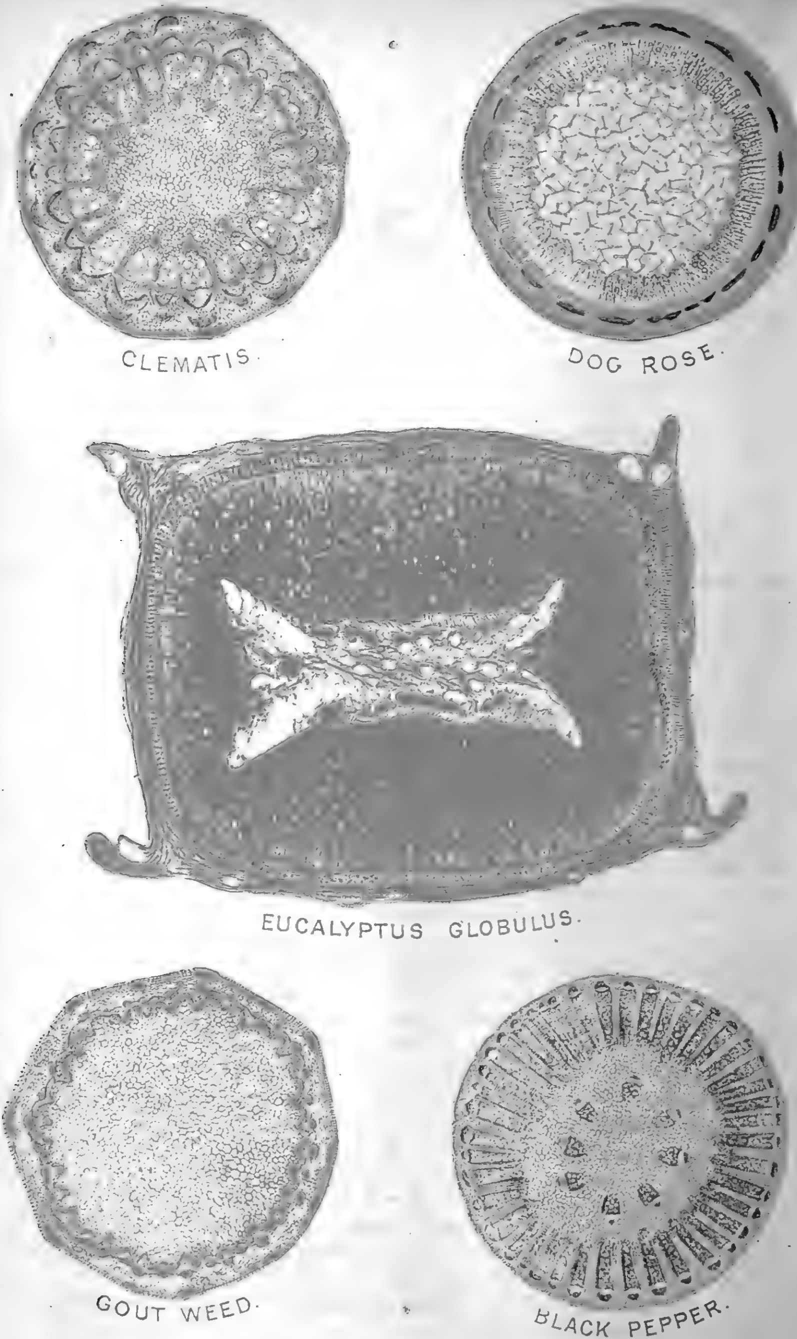
SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

FRONTISPIECE.



WOOD SECTIONS — DOUBLE STAINED.

THE NORTHERN MICROSCOPIST.

No. 11. *NOVEMBER.* 1881.

A VERIFICATION DEPARTMENT.

THE recent papers by Prof. Abbe upon microscopical matters, principally connected with the optical portion of the instrument, have led several correspondents to send us their objectives, asking for an opinion as to their resolving, defining and penetrating power, and as an outcome of this we have been requested by several of our friends to open a department for the verification of the various measurements by which objectives are generally sold.

Now, our first thoughts were decidedly unfavourable to the views of our correspondents; but lately we have become converted to the belief that by so doing we may be of service to many of our readers when engaged in the selection of objectives.

Professor Abbe has taught us that the resolving power of an objective depends entirely upon its numerical aperture (provided the corrections for sphericity and chromatism have been well balanced) and the defining power of a wide aperture is certainly better than one of narrow angle.

In the Journal of the Royal Microscopical Society for October, 1881, on page 833, line 19, appears the following words:—"Narrow angled and wide angle objectives, if properly made, all being capable of possessing the most perfect defining power." We do not know whether this is to be taken from a theoretical or a practical standpoint—certain it is, however, that when speaking some time ago to the makers of the most perfect objectives in this country as to the supply of a half-inch objective of 40° air angle so strongly recommended by Dr. Carpenter for use with the binocular, they gave the perfectly gratuitous advice, "You must not expect it to define as well as one of the higher angles."

Taking this in conjunction with the fact that all low angles we have met with would never stand deep eyepieces, and certainly have not defined so well as those of wider aperture, we are bound to suppose that the sentence we have quoted is from a theoretical standpoint, and that a treat, in the direction of a *perfect* objective of low angle, is in store for us yet.

The great majority of low-angle glasses in the market are understood, by those able to form an opinion upon the subject, to be made in not so careful a manner as those of wider angle—in fact they were introduced as a set-off against the cheap and imperfect foreign lenses, which found their way into England from the Continent, and, though much superior to them, are *not* thoroughly corrected. It is not to these objectives we have referred in the preceding paragraph, but to the best productions of the leading opticians. If any of our readers doubt this, let them try a half-inch of 35° or 40° over a scale of *Polyommatus argiolus*, using a one-eighth inch solid ocular, or an F ocular magnifying 40, and then repeat the experiment with one of Messrs. Powell and Lealand's of the same power, but of 82° airangle, or Spencer's half-inch of 100°.

According to our experience, which has cost much "siller" and not a few regrets, low angle objectives are useful but in one direction. They possess great working distance, and consequently can be used with ease; they allow of the examination of preparations possessing considerable depth, and give plenty of room for dissecting purposes, or for the illumination of opaque objects. Beyond this property of working distance, low aperture objectives do not possess any advantage over those of wide angle; on the contrary, this latter class may be made to do all that the low angles will do, *and a great deal more.* It may be the fashion for microscopists of a certain school to ridicule that section of their brethren they are pleased to call *Diatomaniacs*, who work with wide apertures; but there are an infinite number of problems which can only be solved by these glasses, and the application of a low angle to these would be of as much use as trying to discover the whole of Saturn's moons with the unaided eye.

Penetrating power, Professor Abbe tells us, stands in inverse ratio to the numerical aperture; but this is only one of the elements which go to make up the *depth of vision* in the microscope.

Now, if the microscopist requires *working distance*, it is absolutely necessary that he select objectives of low angle, but then he sacrifices resolving power and not a little definition. If he cares not for this attribute of working distance, nor wishes to see beetles crawling about the field of vision, or an occasional frog skipping around, then wide apertures will give him the most satisfaction in the long run, and will not cost so much as in buying low angles, and afterwards selling them at a ruinous loss.

In our early microscopical days we believed implicitly in low angles; we had persuaded ourselves that they were the best, and endeavoured to persuade our friends likewise. Thus matters continued until we found by actual experience, free from any theoretical bias, that medium angles gave us quite as much penetration as we

desired and certainly defined much better than the lower apertures, we made a change and have not regretted it since the day when the low angles were swept from the cabinet. Then came Professor Abbe's paper, and our medium angles gave place to wider apertures, as by his teaching it appeared plainly that if penetrating power was required it could be easily obtained by placing a diaphragm behind the back lens of the objective.

Never having seen any idea or device for effecting the reduction of angle in this manner, we thought we had made a discovery, but on talking the matter over with Mr. Dancer, the well-known optician of Manchester, he produced a graduating diaphragm, made in 1871 for this very purpose. His idea was to have an octagonal adjustable aperture (iris diaphragms were not then in vogue) with graduations on the edge figured at each 5, and an index so that the position of the diaphragm might be registered for each "aperture." After this we had one made in the form of an iris diaphragm and it works very satisfactorily.

The question of working distance we have already disposed of, and we hope to have shown how resolution, definition and penetration may be made to work in the same objective, so that it simply becomes a question of angle, and we agree to the statement on page 834 of the Journal already mentioned, "that neither penetrating objectives nor defining objectives are alone sufficient for all classes of microscopical investigation;" for our own part we say—give us an objective of wide aperture and a graduating diaphragm as a means of reducing it when necessary.

But there are apertures and *apertures:* it is one thing to purchase an objective of such and such an angle, and another to find that it possesses it when received. The following episode will fully illustrate this:—

"At a meeting of several microscopists the conversation turned upon the motion of diatoms, notably that of the Naviculæ." Said Mr. Wydangle, "It probably is caused by cilia, too transparent to be seen. "No!" said Mr. Wurkhardt. "It is most probably caused by osmosis, by the escape of the fluids through some cavities in the frustules, and who knows but that the markings we see on *N. rhomboides* may not be minute openings through which the fluid escapes." Mr. Wydangle: "Well, to tell you the truth I'm rather sceptical about the markings on that shell; I have a Robinson's eighth of 140° and have never been able to see any lines or markings to say nothing of any appearance of holes." "Well," said Mr. Wurkhardt, "all I can say is that if your glass will not resolve *Rhomboides* it must be badly corrected, or is not the angle you say"—The old tale "Love me, love my dog"—Mr. Wydangle did not like to hear his objective run down, and declared it *must* be a good one, "for he had spent pounds with Mr. Robinson for years and he was

sure he would not deceive him." "Well," said Mr. Wurkhardt, "bring your objective round some evening and we will put it over Abbe's Apertometer, and if it angles well I will try what I can do on *Rhomboides*."

After a lapse of time Mr. Wydangle took the objective to his friend Mr. Wurkhardt; it was measured over Abbe's Apertometer, and when the collar adjustment was properly fixed the aperture was found to be 0.8 or 106° air angle. Mr. Wydangle was crestfallen; he exclaimed—"what a fraud!! why I gave £8 10s. for that glass and I could have purchased one from Dancer of 110° for fifty shillings," when suddenly fancying he saw his way out of the difficulty, his face beamed with delight and he said:—"Stay a bit, it has an immersion front, perhaps that is 140°." This was tried over the apertometer and found to possess an aperture of 0.76, 70° water angle or equal to 99° air angle. It would have been a waste of time to have attempted the resolution of *N. rhomboides* with an objective of this angle. It will be seen from the table on next page that this nominal one-eighth was more nearly a one-tenth with as low an air angle of 106°, and therefore the price paid for it does not in any way indicate its value.

We hope we have said enough to justify the opening of a "verification department." We could have multiplied instances, but now let us see how it is to be carried out.

Objectives should be well packed in a wooden box, well papered, and a luggage label fully addressed, attached by a string, the package should be fully stamped and registered.

We have fixed the fee for verification at eighteen pence, which can be sent in stamps or in coin, within the box containing the objective. It has been fixed low enough to enable students selecting an objective to pay it, while as there are always expenses connected with such an undertaking, it is hoped the balance will meet them—we do not wish for more.

Upon receiving an objective for verification, the Editor will despatch a post-card acknowledging its receipt, giving the number under which the measurements will appear in the next issue of The Northern Microscopist. Should the sender wish for a copy of the results before it has appeared in the Journal there will be an extra fee of sixpence, and the Editor in each and every case reserves to himself the right of publishing the results in this Journal.

Upon the next page is given the form in which the results will appear, and it may be seen that all the information save the tests for definition, dependent upon errors of sphericity and chromatism are there shown.

OUR VERIFICATION DEPARTMENT.

EXPLANATIONS.—Columns *a* and *b* give the denomination of the objective as issued by the maker. Columns *c*, *d*, and *e* show the results of measurements made at a distance of TEN INCHES from the front lens of the objective, to the plane surface of the eye-lens of the ocular. The column *d* shows the actual distance between the upper surface of the covering glass and the front of the objective, when used over a slide of *Amphipleura pellucida*, the frustules being mounted dry, on a cover suitable for observation with a one-twenty-fifth dry objective.

The eyepiece used is a Ross A, with a diaphragm aperture of 0·75 inch, and yielding approximately an amplification of 5 diameters.

Column *f* contains the results of the aperture measurements by Professor Abbe's Apertometer; they are the mean of several, but the individual measurements scarcely differ from each other. Column *g* is calculated from the numbers in column *f*.

REGISTER NUMBER.	SOLD AS		AT TEN INCHES.			REAL APERTURE.		REMARKS.
	a Inch.	*b* Air-angle or Aperture.	*c* Amplifying Power. Diameters.	*d* Working Distance. Inches.	*e* Absolute Size of field. Inch.	*f* Numerical.	*g* Air-angle.	
Number 1......	4	8°	11	3.420	0.4500	0.070	8°	
" 2......	2	14°	24	1.400	0.2260	0.125	14°	
" 3......	1	25°	42	0.420	0.1400	0.210	25°	
" 4......	1/2	60°	94	0.120	0.0540	0.423	50°	
" 5......	1/4	85°	205	0.035	0.0240	0.675	85°	
" 6......	1/8	140°	440	0.009	0.0125	0.800	106°	Dry front.
" No. 6......	do.	do.	430	0.040	0.0125	0.760	99°	Immersion front.
" 7......	1-15	150°	600	0.022	0.0082	0.887	125°	

Objectives for verification must be sent by post—*registered*—to the Editor with the fee of 18 stamps for each objective; they will be returned as a registered package.

MICRO-FUNGI IN NOVEMBER.

AS November approaches, micro-fungi accumulate in a marvellous manner : the innumerable leaves lately green and beautiful on the trees have been scattered in all directions by the autumnal winds, and lie about in a state of decay, but upon them, almost without exception, there still is life. The leaf-fungi of the spring and summer have for the most part consumed that portion of the leaves on which they were developed, and as they become matured have been carried away to lay the foundations of other crops in the coming year. A rounded hole is all that remains to testify to the destruction which the fungus has effected. Let us now gather a few leaves from the ground and examine them. Sycamore and maple leaves are very abundant, especially if our search be in a wood, which now is the best hunting ground for the student. If this be his first hunt of the kind, he will be startled at the strange black patches he finds upon the above-named leaves, some assuming singular arrangement of configuration, others being mere large patches of intense black; not unfrequently the black spots are arranged on the leaf somewhat artistically, but in all cases they have a shining, undulating surface, and are easily recognised. I shall never forget my first find of the well-known fungus, *Rhytisma acerinum*, in a wood at Chelford, early in my microscopic study. Since then, I have frequently met with it. Willow leaves furnish us with another Rhytisma, *R. salicinum*, and the nettle another, *R. urticæ*, but these, although easily seen, are not so conspicuous as *R. acerinum*. There is one other to which I must refer, namely, *Rhytisma maximum*, which makes its home upon branches of the willow, and when in good condition is a most interesting object. Then the spores in asci may be easily obtained and prepared for microscopic inspection. I have always been more or less disappointed in the examination of other Rhytisma, but never with this. It may be known by its shining surface, but the dimpled characteristic of other Rhytisma is absent.

The genus Dothidea should now be looked for. Various of them have made their appearance earlier, but many linger on to the end of the year. The one on the rush, *D. junci*, is an annual visitor, and may now be met with on the margins of pools where rushes love to grow. Another, which is very common, is *D. filicina*, braken Dothidea. Almost every stem of *Pteris aquilina* is more or less infested with this fungus. Some of the Dothidea grow on decayed herbaceous stems, as *D. stricæformis*. Gooseberry branches are sometimes infested with *Dothidea ribesia*. Other plants become the homes of other Dothidea, but it is not desirable that I should occupy more time with this genus.

The Phacidiacei, of which there are numerous species, and some of which may be easily found on dead leaves. On the holly leaves two species are frequently met with. In woods where the holly is plentiful, the dead leaves of the trees in winter are scattered about in thousands, and almost every leaf is beautifully spotted over with the conspicuous black fungus. The two species I refer to are *Phacidium ilicis* and *P. ilicis pulveracea.*

Leaves of other plants, now dead on the ground, are equally the habitats of members of this family. What I have said must be accepted as an indication of an interesting field of research to the student.

There is a small, bright yellow or orange fungus to be found on damp old twigs and stumps in the shape of rounded spots. After a long continuance of wet weather this is so abundant at times that it cannot be well overlooked, and more especially about this season. It is *Tubercularia vulgaris.* It is also found on dead twigs upon the living tree. I have many times found it thus in Hough End Clough, within about a mile from Alexandra Park, Manchester. If examined, it is found to consist almost entirely of a mass of countless conidia. I have found November the best time to look for this fungus, and when I have set out on an expedition for that purpose I have never failed to secure what I wanted. This fungus is, however, but the early condition of a more interesting plant, known as *Nectria cinnabarina*, in its perfect condition, and I have sometimes found it when the two conditions could be distinctly seen on the same stem, and when the change from the early state of the fungus to its perfect condition was taking place. I have at present specimens in my herbarium of that character by me which I obtained some years ago.

The Nectria belong to the Sphæriacei, as also do the Dothidea, spoken of above, having spores in asci, and it requires a good lens to define them well. A fourth or a sixth is the most suitable power for the purpose.

The industrious student will meet with numerous other micro-fungi during the month equally interesting with those to which I have referred, but I have said enough to point out the vast field of research which lies before him, and I hope I have also said sufficient to stimulate his industry in the pursuit of a study, than which none is more delightful, nor does any provide for him a more ample reward.

THOMAS BRITTAIN.

MACHINE FOR CUTTING AND GRINDING ROCK SECTIONS.

MACHINES for this purpose are generally expensive; but, like most other machines, can be efficiently simplified when their action becomes known. For this purpose, I give a sketch and particulars of one that has been made for me, and can fairly say that it does its work with as much ease and celerity as could be wished.

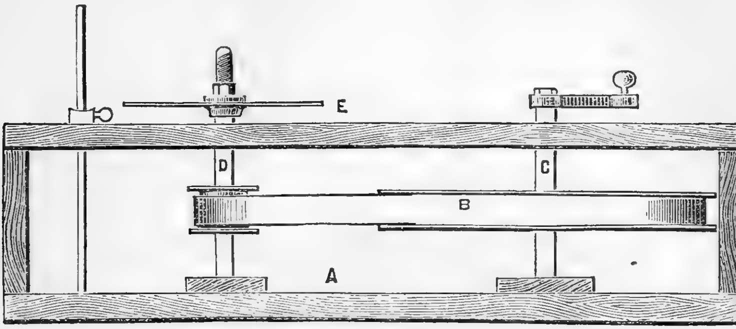
A is a strong wooden box without bottom, with the front side taken off to demonstrate the details inside, consisting of a solid wooden fly-wheel (B) of sufficient thickness to take a tolerably broad strap, and its shaft (C), which at one end is fixed into a piece of wood stretched across the bottom to receive it, and at the other end is the handle. This wheel turns a small drum also of wood and its shaft (D), on which is attached horizontally an ordinary tinned iron disc, about nine inches in diameter, fixed on like a circular saw by large washer and nut. It is safer to have the upper part of the shaft (D) made of brass, as the perfect adjustment of the disc constitutes the main thing.

In one corner is fixed an iron standard, running the entire depth of the box to ensure its perfect rigidity, turned to receive one end of the clenching rod which should rotate freely and evenly. To the clenching iron (K) is attached an iron plate (L) by two thumb-screws (HH). Between these two screws and towards the bottom is another thumb-screw, which does not penetrate the plate (L), but acts as a check to prevent that plate from dipping downwards and imperfectly holding the stone, which is placed between these two plates in front of the disc (E). By means of this a glass slip can be securely fixed without slipping, and if the stone to be cut is delicate, it can be cemented to the slip and a slice taken off *in situ* ready for grinding.

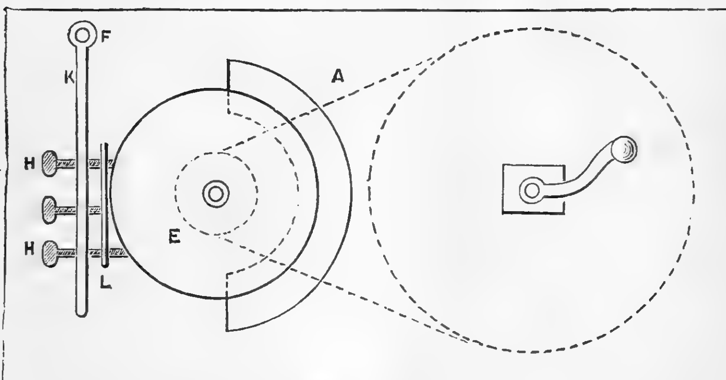
Round the disc is placed a moveable guard box of tin, to prevent the water and dirt from flying on to the operator, and preserving the utilized emery, which comes in use when grinding.

For working the machine—get the specimen as square as convenient, and clench it at the required angle between the plates in front of the disc. With the right hand turn the handle, and hooking the little finger of the left round the clenching rod, thus exerting gentle, even, and continuous pressure of the stone against the disc, at the same time dropping at intervals some *red* emery powder stored between the finger and thumb. The emery is thus taken round with the disc, and is pressed into the soft metal, thus

making a sort of file. Water must be allowed to drop on the disc, but not too copiously. About a square inch of limestone may thus be cut in about twenty minutes, harder stone taking a proportion-

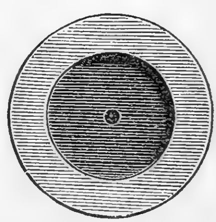


Elevation. Fig. 54.



Plan. Fig. 55.

Plan of Grinding Disc. Fig. 56.



Section of Grinding Disc. Fig. 57.

ately longer time, but by exerting a greater speed I have done nearly twice as much in the same time.

For grinding remove the cutting and substitute the grinding

disc, as shown in Fig. 56, where a circular ring of lead is fastened to a plate of iron. Make the cut piece of stone into a perfect plane on one side by rubbing it on a perfectly even whetstone, and cement that side on to a glass slip in the usual manner. When set, seize the end of the slip between the finger and thumb of the left hand, and having brushed some of the wet emery mud out of the tin guard round the lead rim, set the machine in motion, and gently press the section lengthways across it. If the stone be soft, it is unadvisable to grind with emery to transparency, as the powder becomes incorporated into the stone, but finish with a circular motion on the whetstone. After, cleanse with turpentine and warm water, and mount in the usual way.

I forgot to mention that any number of parallel sections may be cut by simply raising the clenching arm, and tightening the ring underneath by means of a thumb-screw.

A machine after this pattern is simple and cheap in construction, and simple and effective in working, doing the duty of more expensive ones as economically and well.

J. TERTIUS WOOD.

AN INTRODUCTION TO THE STUDY OF FUNGI.*

BY THE REV. J. E. VIZE, M.A.

THERE are very few people who study the interesting plants called Fungi. Hence a very leading object in preparing a paper on the subject necessarily will be to try to allure some one onwards to their study, or at all events if this would occupy too much labour and research, to unfold a fragment of their importance in the vegetable world, and so get for them a little more consideration than has been granted up to the present time.

The wonder is that Fungi has been so much neglected, because really they would, if studied, fill up many and many a period of time which probably now is nothing like so well employed, and take us from nature to nature's God. If a man be fond of his microscope, he will detect shapes as various as the most ardent lover of change could desire. He will find tints amongst the colours of black, brown, yellow, as gradual and progressive from light to shade as anywhere ; he will notice symmetrical forms as exquisite as grace-

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* Paper read at the Sixth General Meeting of the Chester Society of Natural Science.

fulness can be; he will be able to make many a valuable addition to his own knowledge, and confirm the opinions of others, or confute them by noticing what he sees; he will get a gradual, steady progression from one form to another, from one order to another, until he finds that the works of God ramify in every direction, and are all in themselves perfect. There is a rich fund of science amongst the Fungi coupled with pleasure to the man who merely takes his microscope and examines slides under it; but the microscope need not be used merely as a medium of looking at a pretty thing. The adjunct of a camera will prove of great service, drawings can be made, and if made always to one uniform scale of considerable magnitude, the Fungi when drawn will present vegetable shapes vieing with, probably exceeding, the numerous forms of the higher order of plants. When the sketch be made, the draughtsman may use his talent with the paints and the brush, and drive care and idleness away by colouring the magnified drawing on paper from the object still visible under the instrument.

But suppose there be no microscope, and that the privileges just named are not easily attained, if such a thing be possible in these days when first-rate instruments are to be purchased at so low a price; well, of course, a great loss is sustained, perhaps not capable of appreciation, because the luxury has not been within reach. Even then there are in Fungi forms so large and so numerous too that at a rough estimate one-third of the British Fungi need no more for examination than the unassisted eye. Nor should it be forgotten that the present extensive use of the microscope is of recent date, that the pioneers of mycology had nothing like the advantages we have, and to the honour of some of them be it said, they surprise us who try to aspire to their knowledge, by having accurately classified specimens, that we cannot do as they did, because we have microscopes. Hence none need despair. There is such a vast field of work before us all, that the Fungi may be worked with and without the microscope, the whole range may be studied at once, or it may be divided, or even sub-divided, and there will be much to do for a life time.

See, too, the advantages as to the study of Fungi from their being within reach of every one. If you have a garden attached to your house, there you are certain to find specimens. Is your house damp?—very damp?—your wall paper will supply you with an object to examine—possibly three, four, or more from the same strip of paper. The linen hanging up in your cupboards will supply you, if not moved occasionally. Keep your cheese until it gets decayed, there will be something to admire in it. Put your hazel nuts away, then see in course of time the beautiful pink that grows on them. Look at your apples, those somewhat warty-like spots, there you are again. The panes of glass are frequently attacked

with Fungi from the diseased house fly; and specially look at your cellar. But leave home, go a walk, what a pleasure it is to have some object to attain. A blank walk, with no remote end in view, is nothing like as good as that which occupies mind and body too. Outside your own house, the leaves of the trees, the bark of the trees, the branch of the tree stripped of its bark will be very apt to yield specimens. Get into the lanes, the hedges, and ditches, the inside of a wood, still better, the edge of it; look at the gate posts, the stiles, the grass under your feet, the corn-field, the decaying sticks, the utterly rotten wood; all these things positively invite us, at some period of their existence, to study the Fungi.

Again: why should Fungi be so much neglected when they, in common with other studies encourage the generosity and large-heartedness of man. There is, depend upon it, more than an earthly chord struck and well kept in tune by the distribution of specimens. Such an act gives joy to him who parts with his plants and great pleasure to him who receives them. This is, I venture to say, one very great end of Fungi, that their collection and dispersion promotes the nobler feelings of man. And quite right too, for who that is worthy the name of a scientific student would niggardly keep to himself that which would rejoice another. The specimen probably cost no more than the joy of gathering it, and sore must sit the conscience which will not lend, share, or give. My experience is that never once have I asked any fungologist for any help in the way of plants but that help has been granted where it has been possible amongst our English friends, would that I could say the same of every one; and my own belief is that the tendency of any branch of science, where co-operation under difficulties draws men together, is to encourage a feeling that the possession of objects of rarity, be they plants or books upon plants, is an accidental circumstance, for after all men must pull well, and pull together.

The word difficulties was used just now. There are *severe difficulties.* All is not so smooth as what you have hitherto heard, and it is only fair that both sides of the question should be placed before you. Let us then see some of the troubles connected with mycology. Pre-eminently stands the want of books with plates of excellence. There are so few men who study this especial department that the inducement to publish dwindles away from want of support. The investment needed to publish a really standard work is about as bad as could be desired. Any one who attempts it may feel pretty sure that he will not be repaid for his trouble. The purchasers of works on fungology are very few indeed, hence the sale is very limited, therefore few copies can be produced; these works in a number of years become very scarce, then their value

becomes proportionate to their rarity. *Corda's Icones Fungarum* by no means costly at first is now saleable at £28. *Sowerby's English Fungi* seems to be almost extinct. Still if any one really cares to examine the Fungi, the need of books by no means necessitates ignorance of the science; he can make his own drawings, and he can obtain a copy of Dr. Cooke's *Handbook of Fungi*, a work which embraces the information contained in Mr. Berkeley's *Outlines of Fungology*, and in those valuable papers of Messrs. Berkeley and Broome scattered here and there in the *Magazines and Annuals of Natural History*. He can also cope with the times, and the most recent ones too, by subscribing to that record of Cryptogamic Botany issued every quarter, called "*Grevillea*."

But the difficulty about books is nothing like as great to one who wants to become an amateur, as the question, "How am I to begin?" "If I only had some one who would show me how to begin it would be such a help. Some one to put me in the right way." Then comes a sigh, then indifference, then no work for ever. How does the student of Phanerogamic Botany begin? Does he go about asking for guidance? Does he ask to be shown a pretty flower, and just the place where he shall find an account of it in the British Flora? Certainly not. He goes to work on his own account; he finds his plant himself, brings it home, perhaps gets puzzled to ascertain its name, possibly gets help; and if he is not over zealous at first, that embryo student will plod onwards, and become really clever in his department. The sooner he casts off his crutches and labours on his own account the better. Now, if a man thus begins flowers, exactly so may he learn the Fungi. People who do not want to find things unless moulded to suit their ease will not succeed. Let a person go out of doors, let him use his common sense and his eyes, exercise a small amount of patience, and he cannot help finding Fungi. There are upwards of 3,000 already recorded as existing in Great Britain, and he who seeks for them is certain not to labour in vain.

Amongst the difficulties, one may be mentioned here which exceeds those just named, it is that of assigning the correct name to a plant. Some Fungi are in outward appearance very much like others whose orthodox places are very remote from each other. In fact, so difficult is it to say decidedly what a plant is without microscopic help, that the higher authorities rarely venture to name anything off hand, or if they do, it is with the understanding that a critical examination shall be made of it when opportunity offers. Of this we may be sure, that study will unfold the name and place of many a thing which is perhaps unknown for a long time, and of another thing we may be more certain still, that when it is known that a man really does his best to ascertain his plants, there is such a feeling among the lovers of mycology that every one is ready to

help his friend, and to give the assistance in his power. We all know we are ignorant and weak creatures, and that confraternity in science would gladly give the helping hand, whilst it asks others to pass over our own imperfections.

(To be continued.)

OUR BOOK SHELF.

Practical Microscopy by George E. Davis, F.R.M.S., F.C.S., F.I.C., &c., &c. London, David Bogue.

The above work, although not actually published, is now sufficiently advanced to enable us to lay before our readers a synopsis of its contents, and it is done at this early date on account of the many enquiries we have received respecting it.

The matter is divided into fourteen chapters: Introduction—The Microscope Stand—Eyepieces and Objectives—Accessories—General remarks upon Objectives; Test objects—The Collection of objects—Micro Dissections—Section Cutting—The delineation of objects, Microscopic measurements—The Polariscope—The Microspectroscope—Staining and Injecting—The Preparation and Mounting of objects—Reagents; Receipts.

Such is the list of subjects, and it has been the author's aim to make each chapter as complete as possible in itself, preserving an order throughout the work so that almost anything might be found without referring to the index. As to this last portion, nearly everything of interest to the practical worker has been double and treble indexed in order that reference to the subject matter may be made with facility.

The work is profusely illustrated, containing over two hundred and fifty woodcuts and a colored plate for the frontispiece.

The author has endeavoured to show throughout the entire work how the Microscope may be used as an aid to the advancement of knowledge, and how much more useful and permanent work may be done if the operator only possessed an accurate knowledge of his instrument, and of the various reagents used in the Microscopic art.

With this end in view, it has been found necessary to refer to Professor Abbe's researches; but with the exception of giving a rough outline of them, they have been left for a future edition, at a time when his views will not be in the minority. It has been

deemed inadvisable—at least at present—to trouble the reader with too much theory, and the little that has been said upon the subject of Microscopical definition, it is hoped is sufficiently lucid.

The author has not fought shy of the "angle" question. He recommends moderate angles for general work, because such objectives have long working distances and can be employed without any trouble; but where excellent definition is required, none but the widest apertures should be used.

In chapter II. is to be found a table of the magnifying powers of English objectives, and also similar ones of those of Messrs. Zeiss and Hartnack, which may be useful as a means of comparison of the work done with English and Foreign glasses.

Chapter V. has been written with the view of aiding students in the manner of illuminating their subjects, for it is a matter patent to experts, that with beginners the chief errors arise through bad illumination, and even older Microscopists are often at sea in this respect. It is astonishing how much may be done with the bull's-eye condenser alone, yet students as a rule are not aware of it. The various qualities of objectives are treated of in this chapter: Working distance—Defining power—Flatness of field—Penetration—Resolving power; and the author in his arguments has endeavoured not to be wearisome. Most of the "Test objects" mentioned are illustrated, many of them being photographed from nature.

The chapter on the collection of objects is amplified by a list of works treating upon each special subject, while the names of several objects in each class have been given to fix, if possible, the attention of the beginner in some definite groove. Most of these works may be obtained at the Free Libraries, which now are situated in many large towns.

The chapters on Dissecting and Section cutting have been made as practical as possible, ample instructions having been given for the cutting of animal, vegetable, and mineral sections, with the aid of inexpensive apparatus.

Chapter IX. contains directions for the delineation of objects by several means, ruled squares, neutral tint reflector, camera lucida, while the greater portion is taken up with a full description of the art of photo-micrography. This subject is treated of in all its details, the chemical portion being fully explained, including the preparation of transparencies for the lantern.

Chapters X. and XI. treat of the Polariscope and of the Micro-spectroscope, while chapter XII. thoroughly explains the art of staining and injecting. In order to thoroughly set forth the advantages of double staining, the frontispiece has been prepared, which we give as a plate to accompany this number, the four outside figures, representing four of Mr. Ward's double stained wood-sections (as advertised on the cover); the centre figure being a

representation of a section sent us by Mr. Stiles to illustrate his method of picro-carmine staining.

Chapter XIII. contains directions for the preparation and mounting of objects, and though rather a long chapter the author hopes it will be found useful. The last chapter relates to the many reagents employed, and their properties when used upon various substances by the microscopist. There are also appended a list of receipts for varnishes, cements, and other fluids, should the student desire to manufacture them for himself.

NORTHERN SOCIETIES.

BACUP Natural History Society. Hon. Sec.: Mr. George Calvert.

BOLTON Microscopical Society. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER Natural Science Association. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER Microscopical Society. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LINCOLN Science Club. Hon. Sec.: The Rev. W. W. Fowler, M.A., F.L.S.. The School House, Lincoln.

LIVERPOOL Microscopical Society. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER Microscopical Society. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER Cryptogamic Society. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER Science Association. Hon. Sec.: Mr. J. Percival Yates. Meetings Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. North of England Microscopical Society. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM Literary and Philosophical Society. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM Microscopical Society. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH Microscopical Society. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. Hon. Sec., Mr. B. W. Wood, F.R.M.S. Meets on the First and Third Friday in each month.

NOTICES OF MEETINGS.

CHESTER SOCIETY OF NATURAL SCIENCE.—Annual Conversazione.—The annual conversazione in connection with the Chester Society of Natural Science, was, by the kind permission of the Mayor of

Chester, held in the Town Hall, on Thursday afternoon and evening. The whole *suite* of rooms was thrown open for the occasion, and the arrangements of the committee were admirably carried out. The rooms and corridors were, by the kindness of Messrs. F. and A. Dickson and Sons, decorated with evergreens, flowering and ornamental foliage, plants, &c., which considerably enhanced the attractions of the scene. In the afternoon there was a fair attendance of visitors, and in the evening there was a numerous company, the Council Chamber which was specially devoted to a display of microscopes being at times inconveniently crowded.

In the Assembly Room there were large and varied collections, the first in point of interest being those of cryptogamous plants sent in for competition for the Kingsley memorial prize; next came the land shells of the district and the drawings of leaf, flower, and fruit of the horse-chestnut, sent in for competition for the President's prizes. In both classes the competition was very keen, and although there was no second prize offered for the best collection of land shells,

The Council Chamber was altogether set apart for microscopes, of which thanks to the assistance given by microscopists from Liverpool and Wrexham, there were a large number, and during the evening the room was crowded with those desirous of seeing the manifold objects to be seen in connection with the animal and vegetable kingdoms. This year the objects were classified under the heads animal, vegetable, mineral, and miscellaneous, and this arrangement not only proved interesting but instructive. The lowest forms of animals (Protozoa) and vegetables (Protophyta) were placed together at the outer apex of the horse-shoe table, and diverged thence—the animals to the right and the vegetables to the left. .The minerals and miscellaneous exhibits occupied tables under the gallery. The following gentlemen showed in the annexed divisions of the animal kingdom (which was illustrative of the sub-kingdom invertebrata) :—1. Protozoa (the simplest of all animals, having neither body-cavity nor nervous system: Mr. J. D. Siddall, Mr. A. B. Golborne, Mr. W. Oelrichs (Liverpool), Mr. John Griffiths, and Mr. F. Butt. 2. Polystomata (sponges only): Mr. Blower. 3. Cœlenterata (jelly fishes, sea-anemones, and hydras), having a stomach-cavity, and a radiate symmetry: Mr. H. M. Bennett (Liverpool), Mr. A. O. Walker, Mr. G. F. Chantrell, and Mr. John Vicars. 4. Echinodermata (star-fishes and sea urchins), having a body-cavity, stomach, nervous and water-vacular systems: Mr. J. A. Mowle and the Rev. H. H. Higgins (Liverpool). 5. Vermes (leeches, worms, rotifers, &c.), having a body-cavity, alimentary canal, nervous and vascular systems: Dr. Taylor, Mr. T. Shepheard, Dr. Dobie, and Mr. G. Thomas (Liverpool). 6. Mollusca (oysters, snails, &c.), having a true heart and a blood vascular system, alimentary canal, nervous system, and advanced respiratory organs: Mr. A. T. Smith, Junr. (Liverpool), Mr. J. W. P. Edwards, Mr. C. Fish, and Dr. Stolterfoth. 7. Arthropoda (crabs, spiders, insects, &c.), having jointed bodies and limbs, and an external skeleton in addition to the above: Mr. A. W. Lucas, Mr. T. W. Bruce (Liverpool), Mr. I. C. Thompson (Liverpool), Mr. E. G. Tooker (Liverpool), Mr. R. Nicholson (Liverpool), and Mr. G. Day.

Vegetable Kingdom: 1. Thallophyta. Simple plants, often unicellular, having neither stems, leaves, roots, nor fibro-vascular bundles. Reproduced by spores or by division of the cells: Exhibited by Mr. D. Johnson, Mr. W. H. Munns, Mr. M. Johnson, Mr. Birch, Mr. J. B. Manning, Mr. W. J. Baker (Liverpool), Mr. W. Hodges, Dr. Seton Orr, Rev. W. Bannister (Liverpool), and Mr. G. E. Davis (Stockport). 2. Characeæ (Stoneworts only): Exhibited by Mr. E. J. Baillie. 3. Bryophyta. Spore-bearing plants, having stems and leaves, but no true roots or fibro-vascular bundles. Reproduced by spores: Exhibited by Mr. J. Wiseman, and Mr. Davies, 19, Francis-street. 4. Pteridophyta. Spore-bearing plants, having stems, leaves, and roots, all permeated by fibro-vascular bundles. Reproduced by spores: Exhibited by the Rev. J. L.

Bedford, and Mr. T. Bennion-Acton. 5. Phanerogamia. Flowering plants, bearing true flowers and reproduced by seeds: Exhibited by Mr. J. Mills, Mr. Rochfort Connor, Mr. John Shaw, Mr. T. Wakefield, Mr. C. S. Patterson (Liverpool), and Mr. R. H. Job.

Mineral Kingdom: (Illustrative of the microscopic structure of rocks) 1. Sedimentary rocks (rocks formed by deposit of "sediment"), exhibited by Mr. Dickson, Mr. H. C. Beasley (Liverpool), and Mr. Nabb. 2. Organic rocks (rocks formed from plants or animals), exhibited by Mr. Denson, Mr. Shrubsole, and Mr. W. Shone. 3. Igneous rocks (rocks of volcanic origin), exhibited by Mr. W. F. Lowe, and Mr. Bryan Johnson.

Among the miscellaneous exhibits were crystals shown with polariscope, by Mr. H. A. Higgins, Liverpool; Lophopus crystallinus, by Mr. George E. Davis, Stockport; pond life, by Mr. A. Leicester, Liverpool; circulation of blood in young newts, by Dr. McClelland, Liverpool; electric spark under the microscope, by Mr. E. W. Okell; leaf of anacharis with parasitic growth, &c., by Mr. G. F. Chantrell, Mr. W. H. Weightman, and Mr. G. F. Healey. A collection of insects mounted without pressure was shown by Mr. Fred Enock, London.

In No. 1 Committee Room Mr. A. O. Walker showed a fine collection of herbaceous plants, while Mr. R. S. Hudson, of the Bache Hall, exhibited a small collection of living plants.

No. 2 Committee Room was devoted to a lantern exhibition of enlarged microscopic drawings by Mr. Rochfort Connor, which was attended by large numbers during the evening.

Dr. Roberts, of Clare College, Cambridge, delivered an address on "Higher Education," and "The Cultivation of Science," and congratulated the Society upon the hearty and vigorous manner in which its work had been carried on. He strongly inculcated the teaching of science in schools, but at the same time held that literary culture was indispensable. With the increase of knowledge came an increase of pleasure, and therefore it would be admitted that one of the objects of a local scientific society should be to provide so much systematic teaching as was necessary to enable the younger members to study scientific pursuits with increasing interest and profit. The University of Cambridge had done a great deal in the way of promoting higher education in the country. The movement had been started eight years ago through the instrumentality of Professor Stewart, and since then very vigorous off-shoots had been sent out. If the time ever came when the question of national higher education became a subject for imperial legislation he felt confident that the work must be carried on along the lines already laid down.

MANCHESTER CRYPTOGAMIC SOCIETY.—On September 19th, Captain P. G. Cunliffe in the chair, Mr. W. E. A. Axon called attention to the researches of M. H. Fauvel, who had recently examined a number of India-rubber tubes and teats attached to the infants' feeding bottles in the day nurseries in Paris, and these he found to be infected with bacteria and ovoid cells and mycelium of cryptogamic vegetation, the particular species not having yet been determined. The milk used became infected with the same organisms. Specimens of *Leptodon Smithii* in fruit was sent for the society's herbarium by the Rev. H. H. Wood. This beautiful little moss had been found in fruit by him in Dorsetshire. Notes from Herr Jack's recently published monograph on the species of Radula were read by Mr. W. H. Pearson. In it seven species are described, six of which are British, and three of the seven peculiar to our flora. Three new species are described, two of which are also British. *Radula Carringtoni*, named by Herr Jack in honour of the president, Dr. Carrington, as the original discoverer; *Radula commutata* (Gottsche), and *Radula Germana* (Jack), the last species being the one not yet known as indigenous to Britain. A description is also given of the rare British species, *Radula Lindbergiana*

(Gottsche), not *R. Lindbenbergii* as before erroneously named by some authorities. These species had been found in Westmoreland by Mr. George Stabler.

ROCHDALE AND WHITWORTH MICROSCOPICAL SOCIETY.—EXHIBITION AT THE PUBLIC HALL.—A microscopical soirée and exhibition of natural history specimens were held at the Public Hall, on Wednesday and Thursday. The Rochdale and Whitworth Microscopical Society were responsible for the gathering together of the collection, and they may be fairly congratulated on the success which their labours attained. In the first place over fifty microscopes were placed at the disposal of visitors, while the objects which might be looked at through them were almost innumerable. The major proportion of the objects consisted of specimens in natural history, but there were also a few curiosities of another kind. The geological collections were of exceptional interest and value, one lot of fossil specimens including representatives from all the periods between the Silurian and the Tertian, as well as representatives of those periods. They were the property of Mr. James Schofield, Hyde Park, Milnrow-road. Mr. Stirk, Mr. John Petrie, and Mr. J. Tertius Wood had also very interesting collections on view, and they were well stationed in the centre of the room. On the front of the platform was a large number of cases of stuffed birds the property of Mr. Benjamin Schofield, of Bamford. All the birds were victims to Mr. Schofield's gun, and he had also stuffed them himself. A collection of reptiles, in spirits, was fixed behind, and in the rear again was the alligator from the Town Hall. The whole of the collections we have mentioned above, with the exception of the one belonging to Mr. Schofield, of Hyde Park, were ranged in the centre of the room, along with a number of miscellaneous collections. Then behind the erection on which the microscopes were fixed were many other objects of interest. Beautiful cases of preserved butterflies were here on view, and marvellous assortments of birds' eggs. Pretty exhibitions of conchological specimens were also arranged, and more fossils and minerals. In the rear of the platform Mr. R. Robinson, of Belfield, for several hours each day, gave lucid explanations on atmospherical waves, and each evening a gentleman of eminence in the scientific world delivered a lecture in the adjoining room, illustrating his definitions by the aid of the oxy-hydrogen lantern. In the evenings also the hall was lighted with electric light. We must not forget to mention what was perhaps not the least attractive feature of the exhibition, a refreshment stall, and then our readers will have a good idea of the excellence of the exhibition, and also of the pleasure which the large number of visitors who attended could not fail to experience.

The number and description of the objects shown under the microscope was great and various. Amongst them were to be seen Ophiocoma from the deepest "Lightning" dredging 650 fathoms; Globigerina from "Porcupine" dredging 3650 fathoms; and Orbitolites from the "Challenger" expedition, presented to the Society by Dr. W. B. Carpenter; a series of interesting slides illustrating fossil botany by Lieut. J. Tertius Wood; Calamites, Ligenodendron, Sigillaria, Asterophyllites, and many others. Mr. I. Renshaw exhibited a miscellaneous collection, many of which were of much interest: Polycistina, from Barbadoes; Formanifera, from Dogs Bay; Physiological slides, Marine Algæ, and cyclosis in Nitella. Mr. W. Mills showed several beautifully injected specimens of Human brain, tongue, and kidney. Pond life was exhibited by Dr. J. H. Worrall, J.P., Mr. J. Astin, Mr. Squire Ashton, Mr. J. Tetlow, Mr. John Waddington, and Mr. H. Goodhead. Under this denomination appeared, *Stentor polymorphus*, *Carchesium polypinum*, *Cristatella mucedo*, *Limnias ceratophylli*, *Lophopus crystallinus*, *Hydra viridis*, *Volvox globator*, *Melicerta ringens*, and others. Miscellaneous objects were also shown by Mr. A. D. Hall, Mr. J. Burton, and Mr. Spencer Smithson, the most interesting being:—

Section of stem of nutmeg tree, Palate of cuttle fish, Circulation of blood in frog's foot, Head of bee, *Pulex irritans,* and various diatoms. Mr. Thomas Collinge, the Borough analyst, exhibited a number of slides showing the adulteration of food-stuffs.

The Vicar, the Rev. Canon Maclure, had consented to open the exhibition, and between three and four o'clock, in the presence of a large assembly, the ceremony was performed.

Parasites and Messmates.

On Wednesday evening a lecture entitled as above was given in the Lecture Hall, Acker-street, to persons attending the exhibition, by Mr. C. L. Jackson, F.R.M.S., F.L.S., president of the Bolton Microscopical Society. There was a large attendance, Dr. J. H. Worrall, J.P., of Bacup, presiding, in the absence of Mr. Alderman Baron, the Mayor of Rochdale. The lecture was illustrated with the oxy-hydrogen lime light lantern, the objects being delineated as seen under the microscope.

At the outset the lecturer pointed out the fact that parasites pervade all portions of the animal and vegetable kingdom, and are both external and internal. Parasites have often parasites living upon them so that (as he afterwards quoted parodying Swift)—

The big fleas have little fleas upon their backs to bite 'em,
The little fleas have lesser fleas and so ad infinitum.

Speaking of parasites as not being altogether the worse than useless creatures we supposed them, he said that the most disgusting parasite was the human parasite—the man who preys upon others, converting all God's gifts to a use and purpose for which He never intended them. (Applause.) Some animal parasites merely attached themselves to another body for a home, or to obtain locomotion. Others attached themselves either partially or temporarily for food, or entered the body and took up their abode there. Dealing with external parasites, the first parasite figured was the harvest-bug, so common in the South of England. The next was the itch parasite, which the microscope had done good service in detecting, and so enabled us to deal with the loathsome disease more effectually. The tick infesting sheep was shown, and then the parasite attacking the linnet, the lecturer remarking that birds are perhaps more subject to the attacks of external parasites than animals. The parasite of the ostrich, the one attacking the "house fly" (under which general name there were a good many species), and one attacking a species of beetle, having been figured, the lecturer came to the common flea, of whom he spoke, in spite of his other feelings towards him, as a jolly little fellow, who eludes one's pursuit in a way which makes one laugh even at his own expense. He described it in its larva and chrysalis stages, and then as a perfect tormentor. The female flea was said to suck human blood and then disgorge it for her young, but as he had never seen it he could not vouch for its truth. Besides the common flea, whose scientific name was pulex irritans, and which was an external parasite, there was another in the West Indies (the jigger) which inserted itself into the flesh under the toe nails, and sometimes caused mortification of the foot. Many of the parasites laid their eggs under the skin of animals, and a large number were thus useful to men. He instanced how one would puncture the body of some unlucky caterpillar in a number of places and insert the eggs. The young developed and lived upon the body of the caterpillar, carefully avoiding the vital parts, but when on the point of turning into the chrysalis state the caterpillar died, and the insects were set free in great numbers to repeat this process upon other caterpillars. He remarked that at the Southport aquarium he found a parasite feeding upon a sea anemone which bore such a striking likeness to one which attacks the whale that he was astonished. The same thing had been observed in America, but how it was that the same creature could exist upon a warm-blooded creature like the whale, and at the same time derive nourishment

from such a widely different organism as the anemone, was more than he could tell. Another parasite attacking the whale was figured, and the lecturer said that by the look of it the parasite might frighten the whale. It was ferocious enough to do so if it was big enough. He had a good deal to say about the different parasites that attack fishes, and particularly carp. One of the chief points of attack was the gills where there was a plentiful supply of blood. There was one curious and apparently most cruel parasite which attacked the eyes of sprats. By a kind of anchor (or barb) it attached itself to the centre of of the sight of the creature's eye. It was not unusual to find several of these parasites in one eye. Having dealt with external parasites, some of which bury themselves in the bodies of the victims, having inserted themselves into the flesh, he spoke of the internal parasites. A most curious fact in connection with the life history of some of these was that they required to live first in one body, and then complete their existence in another and widely different organisation. He instanced the dreaded trichinæ. The tape worm in man was caused, he said, by an animal whose first home was the pig. A parasite which attacked the dog had its first home in the rabbit, and one that attacked the cat had its first dwelling place in the mouse. A tape worm found in the snipe was illustrated. A parasite which sometimes caused enormous destruction amongst flocks of sheep was supposed first of all to be a small snail which was in the herbage. Just as Virgil supposed of bees, it had been thought that these parasites had no ancestors, but the life history of very many of these forms was now well known. Concluding with reference to parasites, he especially referred to fevers caused by bacteria getting into the human organism, and with reference to the suggestion that it might be possible to secure immunity, by means of vaccination, from various diseases caused by parasites, he said he was afraid that if it could be carried out one vaccination would destroy the effect of another. What was required was to find something that could destroy all these kinds of organisms without affecting the human body seriously. In the second part of his lecture he dealt with "messmates"—widely different creatures who follow each other and the two live quietly side by side, but by what bond of union we could not discover. He instanced the pilot fish and shark, prairie owls and prairie dogs, barnacles and whales. A very pretty description was given of parasitic anemones attaching themselves to the hermit crab. He related an instance of hermit crabs being placed in a tank where there were anemones. These at once showed as much commotion as they were capable of, detached themselves from the piece of rock, and attached themselves to the hermit crabs.

Queer Plants.

On Thursday evening a lecture under this title was given by Mr. G. E. Davis, F.R.M.S., F.C.S., Editor of the *Northern Microscopist*. Dr. Welsh, of Whitworth, presided, and there was a large audience. The lecture consisted first of interesting observations on the immense varied characters of vegetation, commencing with the forest growth of various countries, such as the bamboo jungles of India and the coco-nut groves of China and Japan, lantern slides of which were exhibited.

The lecturer next showed his audience a photograph of a tree-fern, and illustrated his remarks upon their structure and that of the flowering plants with photographs from nature of various sections, the disc of deal and the stem of rush being amongst the number.

One of the most interesting subjects of the lecture, at least to many members of the Society, was the reference to coal plants, a study much followed by several in the districts of Oldham and Rochdale, the Calamite, the Lepidodendron, Asterophyllite, Sphenophyllum, and Annularia, were all thrown upon the screen.

The Mosses, Lichens, and Hepatics were mentioned as being fair fields for study, after which the motile algæ were minutely described, one of Dr. Maddox's

beautiful lantern transparencies of *Volvox globator* illustrating this section. Diatoms were next placed before the audience, being illustrated by three slides, the *Isthmia nervosa*, *Licmophora flabellata*, and *Pleurosigma angulatum*.

This brought the lecturer to the fungi, really the "Queer plants" of the evening, and of which many specimens were thrown upon the screen. There was the *Peronospora infestans*, or potato disease, which last year produced such havoc amongst our crops; and the wheat mildew, or *Puccinia graminis*, to be found in every corn field. The wheat-bunt, or *Tilletia caries*, was also exhibited, being drawn upon ground glass by the lecturer, colored, and finally varnished as recommended by Rev. W. H. Dallinger.

The mildews which attack decaying substances were next treated upon; they are generally styled black moulds, and there are many forms for study. The lecturer gave illustrations of some of the many forms he had found on cotton goods, such as Helminthosporium, Macrosporium, and Mucor, while some, as the *Dactylium dendroides* and *Triposporium elegans*, were beautiful transparencies.

NOTES AND QUERIES.

Bacup Natural History Society.—At a meeting of the Microscopical Section of the above Society, held on Thursday evening, October 13th, 1881, Mr. James Holmes read a short paper on "Minute Organisms," after which the following objects were shewn :—

Objects.	Exhibitor.
Actinophrys sol	Mr. R. Willder.
Volvox globator	,,
Stephanops lamellaris	,,
Nais proboscidea	,,
Hydra fusca	Mr. Jas. Holmes.
Fossil diatoms. Triceratium robustum	,,
Recent ,, ,, fimbriatum	,,
,, ,, Aulacodiscus formosus	,,
Euglena viridis	Mr. Geo. Calvert.
Hydra viridis	,,
Foraminifera. Lagena vulgaris	,,
Trachea of Dytiscus marginalis (larva)	,,
Embryo mussels...	,,

The Society's Rooms are situate in Rochdale Road, Bacup, and are open to members from 8 a.m. to 10-30 p.m. every week-day. About the rooms are arranged various Natural History specimens, Aquaria, Fossils, and Fernery, &c. On the table may be seen the "Manual of Infusoria," "Science Gossip," &c., and a well fitted up Microscope for the use of members at any time; there is also a good Reference Library.

Carlisle Microscopical Society.—A general meeting of the

members was to have been held on Thursday, the 27th ulto., to consider the following resolution :—

"That this Committee is of opinion that it would be of advantage to the Microscopical Society if it was disassociated from any other Society whatsoever."

THE "ACME" MICROSCOPES of J. W. Sidle & Co., Lancaster, Pa., U. S. A.

The following prefatory remarks are taken from the catalogue of the above firm. We wish every maker of Microscopes in this country could say the same :—

"We desire to call special attention to the fact that the tubing on all our stands is of the same diameter ; consequently, we have but one size and quality of eye-piece.

"The diameters and standard screws in centres of stages of Nos. 3 and 4 are alike, permitting here of the use of the rotating or mechanical stage on either instrument, and also of an interchange of accessories.

"All our sub-stages are of one size, hence the sub-stage accessories are adaptable to all our stands.

"All our Binoculars are furnished with removable and extra nose-pieces.

"These are points of no small importance."

DAMMAR AND BENZOL.—Place three ounces of gum dammar in a wide-mouthed stoppered bottle and pour in six ounces of benzol. After a time, with frequent agitation, the whole will be dissolved. Allow to settle, and carefully pour off the clear portion for use.

GUAIACUM VARNISH.—Take—

Gum Guaiacum	2 ounces.
Shellac	2 ,,
Methylated spirit	10 ,,

Powder the guaiacum, dissolve in the spirit, and filter ; then add the shellac to the filtrate and digest in a water bath until dissolved. This varnish is not acted upon by benzol ; it may therefore be used for closing cells, afterwards to be finished with white zinc varnish. It is not so brittle as shellac dissolved in alcohol.

TURNTABLES.—The Editor of the American Monthly Microscopical Journal takes exception to our article on this subject, because the "Congress" turntable has been entirely overlooked, "and several of the later American forms have been entirely ignored." We are sorry for this, but how can we be expected to know of *all* these things, if the makers of them will not send us descriptions. As it is, we consider Aylward's the best turntable extant, "Congress" or no Congress.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

J. R. (Rochdale).—Your fungus is the *Arcyria punicca*, one of the Myxogasters.

T. W. (Ashton).—The moss came to us too much damaged by the post to discover any fungus upon it. If you send us a slide, mounted, to show fungus *in situ*, we may be able to help you. From your description it would appear to be a species of Trichia.

F. S. L. (Bristol).—Thanks for your letter. You may be sure we wish to do exactly as you indicate; but above all it is necessary to consider the cost.

J. C. (Leeds).—You should apply to Mr. Bolton, of Birmingham; he will be able to supply you with organisms illustrative of pond life.

G. C. B. (Hull).—We may be able to give an article or two next year. About June would be the best time.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

MATERIAL.—Wanted, Material and Slides; will give Books, Slides, &c., in return. F. S. Lyddon, of Oakland Villa, Redland, Bristol.

SLIDES.—Well mounted Slides of Embyro Mussels, Santonine, Salicine, for other Slides of interest or unmounted objects. George Calvert, Bacup.

STAINED LEAVES, botanical and anatomical sections, echinodermata, micro-fungi, and all classes of microscopic objects. F. R. Martin, Clevedon.

MICRO-SLIDES.—Marine algæ, principally with diatoms *in situ*, illustrating many species; also a varied and interesting collection of prepared material, mostly marine, for exchange. Wanted photo-apparatus or lantern slides. T. McGann, Burren, Co. Clare.

GOMPHONEMA GEMINATUM.—A very pure gathering of this diatom (in spirit). A one ounce bottle exchanged for twelve best quality micro-slides. Sample tube for three good slides. J. Lillie Mitchell, 6, Mansfield Place, Edinbro'.

VEGETABLE TISSUES stained, and foraminifera, all well mounted, for other good slides. J. Ford, Tettenhall, Wolverhampton.

SALE AND EXCHANGE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

BINOCULAR MICROSCOPE.—A good Binocular Microscope, mechanical stage, with pair of A eyepieces and one each B, C, and D, Selenite stage, Morris' stage, Achromatic Condenser, Polariscope, Camera Lucida, double nose piece, Bull's eye condenser; in Mahogany Cabinet, with 2 and 4 inch objective. Price £13. Approval. B. D., care of Editor NORTHERN MICROSCOPIST.

IMMERSION OBJECTIVE.—A Splendid one-fifteenth Immersion Objective, as good as new. What offers? B., care of Editor NORTHERN MICROSCOPIST.

The Northern Microscopist.

No. 12. *DECEMBER.* 1881.

AN INTRODUCTION TO THE STUDY OF FUNGI.

By the Rev. J. E. Vize, M.A.

Continued from page 266.

NOW about Fungi themselves. What is their place in the vegetable kingdom? Are they especially to be distinguished from their allies? Acknowledging that all lines of demarcation are optional and therefore not necessarily rigid, there are certain means by which Fungi are separated from their close companions Algæ and Lichens. An Alga draws its nourishment through the whole of its surface through the water in which it grows absolutely, or the excessively moist place of its existence which is the same to it as water; besides this it is propagated by means of zoospores, tetraspores, etc. Lichens are propagated by means of sporidia contained in asci, also by green bodies which occur in their frond or thallus, called gonidia. Fungi are propagated by bodies called spores or sporidia, and they are nourished from the substance on which they grow through their mycelium. Fungi are in fact flowerless plants formed of cells or threads or both combined, but never having gonidia like lichens. "Their fructification consists either of cells attached externally to threads which either arise immediately from their mycelium, or from an especial fructificative tissue, and which are then called spores, or of similar bodies produced in little sacs or tubes, and then called sporidia." A singular fact is observable about Fungi, so singular indeed that it has been proposed to assign them a special locality between the animal and vegetable kingdoms; "they absorb oxygen and give out carbonic acid,"—hence their office occurs to be, at all events in this respect, like an animal, in confirmation of which you will never find a fungus with the beautiful green color of vegetables; but if there be green at all, it is invariably of a metallic tint.

Having defined what a Fungus is, and distinguished it from

Algæ and Lichens, let us see some of the uses of Fungi. Amongst other things they are of immense use in destroying vegetable life which otherwise would be most offensive and pestilential. Most of us know how very bad decaying plants smell; take the cabbage and lettuce for instance, and yet what would they be unless Fungi attacked them—they would simply be intolerable. M. Roumeguère published a work in 1870 called "Cryptogamie illustrée," in which he gives a list of all the Fungi which attacked anything and everything. He records 220 which grow on the different parts of the *Fagus Sylvatica* (L). What should we do unless the beech had some agent whereby its life when passing away were accelerated? and what if when death had set in, some assistance were not rendered to hasten its annihilation? And the beech is one of the mildest of all examples we could select, inasmuch as the leaves are anything but fleshy, and their decay would therefore cause less smell than many others when decomposition sets in. And how how very beautifully God has arranged for this decay without injury to our health to take place. The spores and sporidia—in easy language, the seeds of Fungi—are wafted through the air in myriads; they are infinitely small, but of such specific gravity that in due course of time they fall, and settle themselves with a view to growth. Multitudes of course perish and come to an untimely end from lack of the exact spot with necessary accompaniments to cause permanent vitality. Many, as can be proved, start into existence and begin to vegetate, but the requirements are not there in full; they die in their very cradle. But supposing a spore or sporidium finds everything adapted for it, it grows and flourishes, but how does it do this? It does so by means of its mycelium. Moisture which is essential to the life of Fungi causes a process to start from the spore—that process is capable of elongation; it grows, branches out in all directions, yes even into the hardest woods; it feeds upon the parts that it touches, thus proving itself a fungus, and as it feeds it of course consumes the matter around it and so rapidly hastens on decay. Let a spore find its proper place on a laurel or cabbage, or potatoe, how fast, how very fast the mycelium will make its way into it, ramifying right and left in every direction, and by this beautiful arrangement by keeping its life in health gorge those very poisons to us which are food for them. Yes, if there were no Fungi, there would be far more illness. It is very singular how the mycelium furnishes different forms of Fungi; that is to say how different forms of fructification proceed from the same mycelium a branch of our subject which may perhaps well be considered now under our present action of the uses of Fungi. If a mycelium produced only one form of fruit some of the species must be lost, but there is less prospect of such an event now because from the same low form of fungus will arise

one, two, three, four or more different kinds of fruit, all of which are capable of being again the starting points of their species. For instance, there are the dust-like productions called conidia, then the macro-conidia, the pycnidia, stylospore, the ascospore. Many an interesting research has proved this to be the case, and proof after proof is furnished by those who investigate these things, that the moulds are the forerunners of higher forms of life. Hence one use of the study of Fungi is to look into these, because they give us such interesting materials. The ease of the study is not lessened thereby, but the pleasure and profit will be.

Take another point: how useful they are medicinally. The ergot of rye has saved life, although its abuse may have deprived this world of many an existence; still we have not now to examine the abuses to which Fungi may be applied, and no doubt can exist that the ergot has been most beneficial. The testimony to this, however, may be left in the hands of those whose mission on earth is to cure the bodies of their fellow beings; they can tell you far better than myself how the ergot has been used for good. In its young state it is by no means unfrequent in wet seasons; generally, however, it is overlooked. A really practical paper on it was read by a Mr. Watson at the conference of the Cryptogamic Society of Scotland, held at Perth in September, 1875, in which the names of twenty-one ergotised grasses were given. He considers that cultivation of land has had something to do with decreasing the occurrence of ergot in Scotland, and that if grasses were allowed to grow now as they used to do before drainage had so much to do in carrying off the water from the land, the cereals would produce a great many more ergotised grains than they do now. Still there is the fact patent to all those who look into the matter, that the Ergot of Rye is of vast importance in the medical world.

Look too how useful the Vinegar Plant is, and what is it but a vegetable produce caused by the growth of the mycelium of a fungus (*Penicillium crustaceum*) in saccharine liquor when not in a state of fructification?

Then see how essential Fungi are in the making of bread. The fermentation of the dough is due to the growing of a fungus, which fungus causes the bread to be light and wholesome which otherwise it could not be. It is a species of Torula which forms the yeast; it feeds upon the sugar of the flour, the consequence is that carbonic acid gas is set free all through the dough. The dough is put into the oven, the heat of which is so great that in the process of baking the gas is driven off entirely, thus leaving the fungus to be baked, its vitality utterly destroyed, and its remains, which of course do not come out with the gas, to be eaten as part of the bread. Thus every day of our lives we are fungus eaters.

Yes, Fungi are of more use than we at first think; unless it were

for them many a blessing we now have would be withheld from us.

But whilst thus we speak of their uses, it cannot be denied that there are many instances in which great injury is done by them. Smut is very often found in fields of corn, although in the present day it would seem that its growth has by artificial means been greatly checked as compared with years gone by. It takes an early period for the destruction of the good properties of the cereals, and thoroughly neutralizes the true qualities of the ear. Bunt does the same, differing however from smut, inasmuch as its presence is not so easily ascertained; the ear of corn looks much the same at first as though it were not attacked, but squeeze the ear between your fingers and the fœtid smell will quickly prove what you have been touching. A microscopical examination will soon show other varieties.

Human beings suffer occasionally from the attacks of Fungi. There is a disease from which the natives of India sometimes suffer called the fungus foot of India. Strange to say, the disease never ascends higher than the base of the leg bone, just above the ankle. Mr. Berkeley has given an excellent paper on this malady in the "Intellectual Observer" of 1862. The first case he mentions is one in which the bones are "perforated in every direction with roundish cavities varying in size from that of a pea to that of a nut or pistol bullet, the cavities being filled up with a dense fungus mass of a sienna red within but externally black, resembling a small dark truffle. From these cavities, canals lead to the surface, from which a purulent fœtid discharge is poured out, often accompanied by little pieces of the fungus." It is needless to say that in cases of this kind amputation is necessary to save life, and that the disease must necessarily be of a most painful kind. Two other kinds of foot fungus are recorded by Mr. Berkeley in the same paper.

In our own country there is a disease to which we are all liable, and which is emphatically a fungus; one which causes a good deal of unpleasantness rather than pain, and which isolates people who have it considerably. I mean ring-worm. Ring-worm is a fungus; it has its mycelium and filaments, and bears its spores. These spores are very minute and are easily conveyed through space. Hence the probability of getting the disease arises from the spores being deposited on some suitable place for growth, when they will vegetate and grow. Whether the spores would develope when the skin is perfectly healthy, or whether some weakening cause be needful it is not for me to examine. Nor need we ask here whether the ring-worm is the result of disease arising from the epidermal structure being out of order, or whether one's system is not braced up to its usual strength, and so the constitution is predisposed to

attack. My own notion is that ring-worm is very easy to cure. Two essentials are needful, and if used are almost certain to be effectual in a short time. So sure are they that I have known an instance wherein a family had for months the ring-worm and yet were well in a very short time. The cure is recorded I believe in the Proceedings of the Literary and Philosophical Society of Manchester.

Insects are also liable to be attacked with fungoid parasites. The silkworms in France have suffered severely. Wasps have been seen alive infested with a growth which eventually deprived them of life. Between twenty and thirty species of ascigerous Fungi have been recorded as parasitic on insects. One of our British specimens is very beautiful; it grows on the pupæ of moths buried in the ground in the autumnal part of the year, and it is of a splendid orange red colour, scarcely two inches high, covered in its clavate head with tubercles. The contrast between the scarlet head of the fungus, and the green grass in which it grows is very gladdening to the sight of the mycologist who has never met with a specimen in his work. Let us not forget whilst speaking of the Fungi attacking insects, that many insects live upon Fungi; they are natural food for them. If you want the insect find the fungus on which it feeds, and you will get what you want.

But let us examine a little now into the Potato disease, which, as most of you know, is a fungoid growth, and has caused so much injury to the potatoes for years past. A popular idea prevails that the potato disease comes down with the warm rains of summer. The notion originates in the fact that the leaves of the potato are seen to be diseased after the showers of July. This is a fact, and you will observe that when there is an absence of rain, the leaves have not that brown spot upon them; rain is essential to their development, and must come, or there must be very heavy dews at night to answer the same purpose. Wherein then is the fallacy as to the disease coming in the rain? It is in this, that the rain by no means has the disease in itself. It only causes to grow that which was already awaiting considerable moisture before it could vegetate vigorously. Moreover the brown spots on the leaves are not the first startings of the disease; they are only proofs that the disease is at work elsewhere. The first part affected certainly is the tuber—that part of the potato which which we eat at table—the tuber is affected by what we call the resting spore (oospore), which is dormant for nearly the whole year.

(To be continued.)

"THE NORTHERN MICROSCOPIST" VERIFICATION DEPARTMENT.

EXPLANATIONS.—Columns *a* and *b* give the denomination of the objective as issued by the maker. Columns *c* and *d* show the results of measurements made at a distance of TEN INCHES from the front lens of the objective, to the plane surface of the eye-lens of the ocular. The column *d* shows the actual distance between the upper surface of the covering glass and the front of the objective, when used over a slide of *Amphipleura pellucida*, the frustules being mounted dry, on a cover suitable for observation with a one-twenty-fifth dry objective. The column *e* gives the actual focal length of the objective determined by Cross' formula $\frac{n\,l}{(n+1)^2}$ where l = the distance between the two micrometers and n = the amplification at this distance.

The eyepiece used is a Ross A, with a diaphragm aperture of 0·75 inch, and yielding approximately an amplification of 5 diameters.

Column *f* contains the results of the aperture measurements by Professor Abbe's Apertometer; they are the mean of several, but the individual measurements scarcely differ from each other. Column *g* is calculated from the numbers in column *f*.

REGISTER NUMBER.	SOLD AS		AT TEN INCHES.			REAL APERTURE.		REMARKS.
	a Inch.	*b* Air-angle or Aperture.	*c* Amplifying Power. Diameters.	*d* Working Distance. Inches.	*e* $\frac{n\,l}{(n+1)^2}$	*f* Numerical.	*g* Air-angle.	
Number 8......	1.25	... ...	26	1.33	1.25	.12	14°	
" 9......	2/3	... ...	55	.46	.64	.25	30°	
" 10......	4/10	... ...	100	.11	·37	.41	49°	
" 11......	1/4	... ...	150	.04	.24	.48	58°	
" 12......	1/2	... ...	110	.06	·33	·51	62°	
" 13......	1/4	... ...	195	.01	.20	.63	78°	No. 14. Collar adjustment at 'closed.'
" 14......	1/8	140°	330	.01	.115	·93	137°	Minimum angle 112°.
" 15......	2.0	... ...	26	1.00	1.20	.155	18°	

Register Number.	Sold as		At Ten Inches.			Real Aperture.		Remarks.
	a Inch.	*b* Air-angle or Aperture.	*c* Amplifying Power. Diameters.	*d* Working Distance. Inches.	*e* $\frac{n\,l}{(n+1)^2}$	*f* Numerical.	*g* Air-angle.	
Number 16......	1.0	...	44	.73	.80	.160	19°	
" 17......	B.B.	60°	85	.05	.42	.485	58°	
" 18......	D.	75°	230	.03	.157	.630	78°	
" 19......	D.D.	105°	230	.01	.157	.848	116°	
" 20......	D.D.	105°	240	.02	.161	.755	98°	
" 21......	½	70°	116	.05	.302	.615	76°	
" 22......	⅙	150°	300	.01	.126	.860	119°	
" 23......	3.0	12°	12	1.84	2.15	.075	9°	
" 24......	2.0	...	22	1.06	1.37	.14	16°	
" 25......	1.0	23°	46	.36	.71	.21	24°	
" 26......	1.0	...	44	.40	.78	.225	26°	
" 27......	½	40°	86	.10	.41	.310	36°	
" 28......	1.5	...	38	.91	.92	.122	14°	
" 29......	4/10	...	140	.06	.26	.55	67°	
" 30......	¼	110°	190	.01	.20	.766	100°	
" 31......	¼	110°	190	.02	.20	.780	103°	No. 31 gave the best image with collar adjustment 'open'; at 'closed'; the angle was 105°.
" 32......	⅛	110°	300	.01	.122	.788	104°	
" 33......	1/10	...	320	.008	.116	.850	117°	

MICRO-FUNGI IN DECEMBER.

THOSE readers of the "NORTHERN MICROSCOPIST" who have done me the honour of reading my notes on the subject of Micro-Fungi from month to month during the year, will remember that we began with noticing the two Leaf-Fungi which came upon the scene in the early spring on *Ranunculus ficaria*, generally known as Pilewort or the Lesser Celandine. This early visitor of our meadows with its two most beautiful Micro-Fungi upon its leaves is the harbinger of a complete host of interesting followers. Year by year with unfailing fidelity, this welcome plant with its shining golden petals comes to the front to gladden the botanist and to recall to the microscopist the harvest of scientific study which is about to be prepared for him. At this period we have but two species of Leaf-Fungi, but soon others are developed in great numbers from month to month until a large proportion of the vegetable kingdom becomes decorated or infested with these minute cryptogams—sometimes the pests of the agriculturalist, but always the delight of the microscopist, and also to him the best field for the study of the secrets of nature. If there be a link connecting the animal and vegetable kingdoms here, it is that that link must be found. The eyes of scientists are now greatly turned in this direction, and no one can forecast what the results may be. My desire is not to give an opinion on the matter, but to call the attention of the student to the subject as one of infinite interest well deserving of careful investigation.

The Leaf-Fungi have accompanied us during the months from April to the end of the year, for we are now near its close; but we still have a few to keep us company. The only one within reasonable distance of Manchester to be found in this month is *Puccinia glomerata*, on the well-known ragwort *(Senecio)*, of which there are many species all liable to be infected. This must be looked for in sheltered places amongst the sand hills at Southport or in similar situations. I have found it frequently in a sandy lane about a mile from Southport in the direction of Churchtown. Another *Puccinia glechomatis* (Ground-ivy Brand) I met with near the railway station at Taunton in December, 1873. A third, *Puccinia umbilici* (Pennywort Brand) I found in a sheltered part of the valley which runs betwixt Ilfracombe and Barnstable on a ramble through that valley within a few days of Christmas in 1873. It will be noticed that the two latter species were in Devonshire, which is far away from northern hunting ground; but I am inclined to think that there are many warm nooks far north of Devonshire, where Leaf-Fungi will be able to linger on to witness the end of the year. Doubtless

the short dark days we now have and the drawbacks connected with hunting in rain and snow render it extremely difficult to find them. Notwithstanding this, the student should not neglect any opportunity that may arise, for there is always the possibility of meeting with something to repay him for any hardship he may undergo. The dead leaves (if not the living) are covered with marvellous organisms without number, every one of which is deserving of careful examination, and thus he will obtain ample material for pleasant study during the long nights of winter when comfortably seated by his fire-side with his microscope before him.

On reviewing my notes of the year, I find a crowd of interesting plants belonging to the family to which I have called the special attention of my readers altogether overlooked. This is the result of an absolute necessity, nor was it my wish to enter upon the impossible task of referring to all the members of the innumerable family. My desire has been to be a guide and a help to the microscopic students of the North, with especial reference to those of the Manchester Microscopical Society, and in this character I have been careful to refer chiefly to the results of my personal explorations and discoveries.

It has been a pleasure to me to have had an opportunity of calling the attention of my fellow-students to so interesting a study in The Northern Microscopist, and I have the further satisfaction of believing that the time I have bestowed upon the subject has not been spent in vain.

Thos. Brittain.

THE EPHEMERIDÆ, OR MAY-FLIES.*

By W. Blackburn.

THESE insects are a family of the Subulicorn Neuroptera, to which division of the Order the Dragon-flies also belong. The name—"*Subulicornes*"—was given to them by Latreille, on account of the antennæ having the shape of an awl. The term "May-fly" is restricted scientifically to the genus Ephemera, the type of which is the May-fly of the angler. It is, however, popularly applied to the entire family. The May-fly differs from the Dragon-fly in

* An Abstract of a Paper read before the Manchester Microscopical Society on October 6th.

Note.—Mr. McLachlan in his catalogue of British Neuroptera, 1870, places the Ephemeridæ amongst the Pseudo-neuroptera, between the Stone-flies (*Perlidæ*) and the Dragon-flies.

having an abortive mouth, in the smallness or absence of hind-wings, and the two or three long filaments that form the tail. As it lives in the imago state seldom longer than a day, it does not require food; and, therefore, has no jaws or mouth adapted for prehension or mastication. It leaves these instruments behind it in the water when it emerges from its last aquatic skin; for the larva lives a considerable time in the water previous to attaining the winged form, the time varying with the genus from a few months to about two years.

The Ephemeridæ possess both compound and simple eyes. The antennæ consist of two rather large basal joints surmounted by a bristle, indistinctly jointed, with a somewhat bulbous base. The abdomen has ten segments. The first segment is immoveably attached to the metathorax, and is often of the same colour. This has led some entomologists to describe them as possessing only nine abdominal segments; but the fact that this segment belongs to the abdomen, and not to the thorax, is proved by its possessing, in some of the larvæ, the first pair of aquatic gills, all of which are abdominal, and are thrown off when the insect quits the water; whereas the appendages of the thorax are retained by the imago. The ninth segment is furnished in the male with a pair of forceps or claspers, with which he embraces the female, and the oviducts in the female terminate in openings between the seventh and eighth ventral segments. The legs are short and slender, the front pair the longest; the male has this pair much longer than the female, and advanced more in front of the head. The tarsi have four or five joints, the fifth joint being sometimes nearly obsolete and immoveably attached to the tibia. The anterior wings are large, and never folded; the posterior, if present, small or rudimentary only. In the large wing the costa is "united by a stout cross-veinlet to the radius near the base"; "subcosta uninterrupted at the nodus." The caudal setæ, or tails, are composed of many joints. In some genera the middle tail is absent in the imago; the larvæ, however, all possess three tails. The tails act as balancers during flight. After ascending by the action of the wings, the insect succumbs to the attraction of gravitation, and, during its descent, the tails assist in supporting the abdomen. The male has usually longer tails than the female. His compound eyes are also larger than hers; and in some genera he is provided with a second pair, raised on large pillars on the top of the head. The female never has these pillared eyes. The three ocelli, or simple eyes, are, however, found in both sexes. The male is usually smaller and of darker colours than the female.

These insects are usually described as undergoing quadruple metamorphosis, because when they first appear with wings, they are encased in a thin pellicle which covers the whole body, includ-

ing the wings, and which gives them a dull appearance. In this state, which is called variously by the names *pro-imago*, *pseudimago*, or *subimago*, they fly or crawl to the nearest resting place, to divest themselves of this garment; and anglers have related that, as they sat upon the banks of some stream, on a quiet summer evening, they have found the rims of their hats covered with these "fairy-like" skins of the subimago. It is often asserted that the casting of this additional skin is peculiar to the Ephemeridæ. This is doubtless a mistake; for Newman, Westwood, and others have observed the Dragon-fly and other insects quit a double-skin on attaining the perfect state; but the subimago skin of the May-fly is retained longer than that of other insects.

These insects, however, undergo no true metamorphosis, in the ordinary acceptation of that term. They are born with six legs, two antennæ, and two tails, and almost all the changes they undergo during growth are developmental. The nymph gradually acquires wing-cases, which it uses for purposes of respiration in the water, and is similar in all other respects to the larva that has no wing-cases. When the nymph becomes a subimago, it leaves its long antennæ, jaws, and abdominal gills, and sometimes its middle tail, behind it, with its cast skin, and we find in their place short antennæ, an aborted mouth, and spiracles; but equally important changes take place during the growth of the larva, when it is not supposed to be passing through metamorphosis, and it might be more properly described as undergoing *multiple* metamorphosis, inasmuch as a change of structure is apparent after every moult. Growth and development visibly take place at the same time. There is no inactive state analogous to that of the pupa of the Lepidoptera; the quiescence of that order of insects being necessary on account of their inability to take food during the change of the mandibulate mouth of the caterpillar into the suctorial mouth of the butterfly.

Although the Ephemeridæ pass so short a portion of their lives in the air, their life-history upon the wing is one of considerable interest. The alimentary canal is straight and inflated with gas, which renders these insects very light, and in some genera their soft and feeble muscles render them incapable of strong flight, so that they are often blown about by the wind. In some localities, when atmospheric conditions have been more than usually favourable for their leaving the water, clouds of these insects may be seen hovering in the air, each seeking the final object of its existence, the perpetuation of the species. Their dead bodies have sometimes been found so thickly upon the ground in some parts of Italy, that they have been carted away and used as manure. Swammerdam, the Dutch naturalist, who was the first to investigate with accuracy the anatomy of a May-fly, described a species that

frequents the rivers of Germany and Holland, which made its appearance in great swarms regularly in June. Réaumur, also, on the banks of the Marne, saw countless numbers of these insects in the middle of August. He describes them as filling the air more completely than the thickest fall of snow. Dr. Hagen describes those of the genus Cœnis as being so plentiful sometimes in Prussia that they are used to feed the pigs. Other observers of undoubted veracity have testified to having witnessed similar phenomena. In the British Islands, however, we have nothing analogous to this; although these insects are occasionally found in great numbers under peculiarly favourable circumstances. The *Ephemerica danica*, the May-fly of the angler (Fig. 58), has been seen on the river Dove in such numbers, in the subimago state, as almost to cover the water where it was from twenty to thirty feet broad.

Fig. 58. Imago. × 1½

The swarms of these insects, when they occur, consist mostly of males. Being filled with gas, no food ever being found in the alimentary canal of an imago, the male insect is extremely light. The female, whose ovaries occupy about two-thirds of the abdomen, and must necessarily add to her weight, doubtless finds her powers of prolonged flight more restricted than the male. Besides, she is much engaged in depositing her eggs, after fecundation, in clusters on the surface of the water; for, as they extrude from the oviduct, she is constantly skimming along the surface of the water in order to detach them, becoming at the same time an easy prey to the trout. Having deposited her eggs, she returns to the swarm, and then betakes herself to the water a second time, where she deposits more eggs. She repeats this process until all the eggs are disposed of, after which exhausted nature succumbs, and she dies. In some genera, however, she deposits all the eggs at once, and her life is then much shorter. The life of the male is equally short.

The female, with her ovaries full of eggs, is the insect that the fish prefers; and the wise angler tries to delude his victim with a seductive imitation, which he calls a "Grey Drake." His "Green Drake" is the female subimago, and the "Bastard Drake" the male subimago. All these belong to *Ephemera danica.* The "dun flies" of the angler are mostly Ephemeridæ in the subimago state.

The larvæ and nymphæ are provided with longer antennæ and shorter tails than the imagines. The mouth is well developed, and consists of a pair of mandibles, sometimes prolonged into frontal horns, a pair of maxillæ, with palpi of two or three joints, a labrum, and a labium, with labial palpi. Their food consists of diatoms and other protophytes, mixed with mud; occasionally with protozoa, and in some genera entomostraca, and even minute larvæ, in addition. They either swim or crawl among water-plants

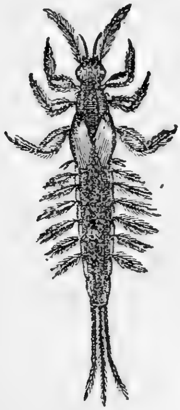

Fig. 59.
Nymph of Ephemera.

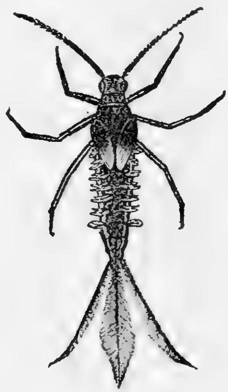

Fig. 60.
Nymph of Clöeon.

or hide under stones. Some genera, however, form horizontal burrows in the mud, in which they find warmth during the winter and security during repose, and from which they sally forth only in quest of food.

All the British genera have external branchiæ, usually consisting of a pair of single or double plates to each of the first seven segments of the abdomen. These gills are lance-shaped, leaf-shaped, oval, or divided into threads. They are sometimes provided with a fringe of membranous threads round the margin, as in Ephemera. (Fig. 59.) Heptagenia, which frequents very cold streams and the rapids of rivers, has seven leaf-shaped gills on each side, each with a bundle of threads attached to its root, the analogue

of a perfect gill. Ephemerella has only the fourth to the seventh segments furnished with gills, the smallest number amongst British genera. Cœnis, with six single gills on each side, all well fringed, has those on the third segment large enough to cover the four hinder pairs, the second segment being without gills.

Baetis and Centroptilum have seven single gills on each side; Cloëon (Fig. 60.) has six double and the seventh single; in these three genera they are oval and without fringe. Siphlurus has two double and five single gills on eachside, without fringe. Ephemera is often described as having only six pairs of double lance-shaped gills, all fringed. It has, however, another pair, very small and plain, on the first segment, sometimes concealed by the wing-cases. Minute branches of the tracheæ run through the gills, and when these are fringed, each filament receives a single branch.

(To be continued.)

NORTHERN SOCIETIES.

BACUP Natural History Society. Hon. Sec.: Mr. George Calvert.

BOLTON Microscopical Society. Hon. Sec.: Mr. W. Rideout. Meets on Friday evening once in each month.

CHESTER Natural Science Association. Hon. Sec. of Microscopical Section: Mr. J. D. Siddall.

DONCASTER Microscopical Society. Hon. Sec.: Mr. M. H. Stiles. Meets twice in each month.

HALIFAX. A Private Society. Members meet at each others houses.

LEEDS. No Microscopical Society in existence.

LINCOLN Science Club. Hon. Sec.: The Rev. W. W. Fowler, M.A., F.L.S.. The School House, Lincoln.

LIVERPOOL Microscopical Society. Hon. Sec.: Mr. I. C. Thompson. Meets First Friday in each month.

MANCHESTER Microscopical Society. Hon. Sec.: Mr. C. L. Cooke. Meets First Thursday in each month.

MANCHESTER Cryptogamic Society. Hon. Sec.: Mr. Thos. Rogers. Meets Third Monday in each month, at Old Town Hall, King Street.

MANCHESTER Science Association. Hon. Sec.: Mr. J. Percival Yates. Meeting Second and Fourth Tuesday in each month.

NEWCASTLE-ON-TYNE. North of England Microscopical Society. Hon. Sec.: Mr. M. H. Robson. Meets Second Wednesday in each month.

NOTTINGHAM Literary and Philosophical Society. Natural Science Section hold meetings Fortnightly on Wednesdays. Hon. Sec.: Mr. A. H. Scott White, M.A.

OLDHAM Microscopical Society. Hon. Sec.: Mr. Charles Walters. Meets on the Third Thursday of each month, in the Club-room of the Lyceum.

ROCHDALE AND WHITWORTH Microscopical Society. Hon. Sec., Mr. I. Renshaw, L.D.S.R.C.S.

SHEFFIELD. Hon. Sec., Mr. B. W. Wood, F.R.M.S. Meets on the First and Third Friday in each month.

NOTICES OF MEETINGS.

BACUP NATURAL HISTORY SOCIETY.—At the usual monthly meeting of the Society, held November 10th, Mr. J. P. Holmes in the chair, it was decided to alter the date of the meeting to the first Wednesday in each month. Mr. J. E. Lord, of Rawtenstall, Vice-President of the Society, exhibited specimens of *Daphnia Bairdii*, *Dioptimus Castor*, *Asterionella formosa*, and a piece of marine Algæ, to which was attached *Hydractinia Echinata*, and a marine hydra very similar in colour and form to *Hydra fusca*, but having considerably more tentacles. Another specimen which received a good share of attention from the members, was a supposed new Sponge (drawings of which had been forwarded to the Editor of the NORTHERN MICROSCOPIST) found in the district by Mr. Lord. This specimen had been seen by Dr. Carpenter, who was of opinion that it was a new one. Dr. Worrall, J.P., Vice-President, exhibited *Trachelius ovum*, *Pterodina patina*, *Euchlanis dilata*, and one of Hynes' Patent Lamps, which seemed well adapted for microscopic work, giving a brilliant, steady flame, and requiring little attention; Mr. A. Wilkinson, *Tardigrada*, *Floscularia cornuta*, and cyclosis in nitella; Mr. R. Wilkinson, Gizzard of Vine Weevel, Gizzard of Cricket, and *Cimex lectularius*.

BOLTON MICROSCOPICAL SOCIETY.—After the usual recess, the above-named Society has commenced the work of the session. At the October meeting, after the Treasurer's report (showing that the Society is in a sound financial condition) had been read, and a number of gentlemen having been proposed as members or associates of the Society, the election of officers for the session of 1881-2 was proceeded with, C. L. Jackson, Esq., F.R.M.S., F.L.S., being re-elected President; Mr. R. Walmsley being re-elected Treasurer; and Mr. W. Rideout, F.R.M.S., being re-elected Honorary Secretary and Curator. The following members were elected as a Committee:—Rev. R. Best, Dr. Hunt, Messrs. R. Harwood, W. W. Midgley, A. S. Pennington, W. Shipperbottom, George Mason, and T. Fawell. The question of a Conversazione having been mooted, it was resolved that as an annual conversazione interferes with the work of the Society, it is not desirable to hold one this year. An interesting paper on *Vegetable Hairs* was then read by Mr. Robert Harwood; after which the meeting took the form of a conversazione, and examined a variety of hairs under the microscope. The issue of slides from the Society's cabinet of objects brought the meeting to a close.

BOLTON MICROSCOPICAL SOCIETY.—We are glad to notice that this Society has commenced the work of the Session with more than its usual vigour, so far as real work is concerned. The Soirée, which has usually been held in the month of November, has been discontinued this year, as it was considered that a gathering on such a scale as the previous one, was an expensive luxury, calculated to amuse the outside world, but paralysing the actual work of the Society for three months at least.

At the November meeting, Mr. A. S. Pennington read an exhaustive paper on "Hydra, and its Allied Forms," of which the following is an epitome:—

The wonderful Hydra of ancient mythology, whose destruction was one of the labours of Hercules, has its anti-type in one of the inhabitants of our ponds and ditches. The animal, to whom the modern name of Hydra has been applied, is the type of a group of animals known as Cœlenterata from their hollow bodies. The Cœlenterata, with other members of the animal kingdom, are popularly known as Zoophytes, or animal plants, from the fact that in external appearance, they to some extent, resemble flowering plants. The Cælenterata are divided into two classes: the Hydrozoa and the Actinozoa, but this paper is

only descriptive of the former class which has been subdivided into seven orders, of which the typical one, the Hydridæ, contains the single genus Hydra, all the members of which are free swimming single animals. The other orders of the Hydrozoa (except the jelly fish) are social animals, and live in clusters or colonies, produced by a process of budding from a single individual. The body of the Hydra consists of a gelatinous sac, capable of varying its shape, having one end extended into a disc or foot; the other being occupied by the mouth, which leads into a capacious cavity, occupying the whole of the interior of the animal. The mouth is surrounded by a circle of tentacles or feelers, which vary in number, and are capable of altering their shape from being short and stumpy to long and filiform. This power is also possessed by the entire body of the animal, and is due to the presence between the two layers of cells, composing the body of a layer of muscular cells or fibres. The size of the *Hydra* varies from less than a quarter to three-quarters of an inch. The walls of which the body is composed are cellular in structure and of sarcode substance. The outer layer of cells known as the ectoderm are furnished with nematocysts or thread cells, each of which contains a long thread which is hollow and connected with a poisonous secretion, contained in the cells believed to be formic acid. When the tentacles are touched, these threads are ejected and piercing, the bodies of the minute objects upon which the Hydra feeds cause the death of the prey and enable the Hydra more readily swallow it. The jelly fish, which are believed to be very largely transition states of massive hydroid forms are endowed with similar cells, hence the stinging sensation felt in handling one of them. The inner cells, or endoderm, are lined with vibratile cilia, which coupled with the amœboid motion of the cells themselves pass the food along the different parts of the body cavity and so aid digestion. No nerves have been discovered in the Hydra, which yet appears to be endowed with great sensibility, shewing the extreme probability of the theory that the nerves and nerve centres in the higher animals are only aggregations of particles which in the lower animals receive and convey impression in the molecules of which the cells are composed. The Hydra possesses an extraordinary degree of recuperative power. It may be cut into segments and otherwise mutilated without its being injured, except to its advantage, for the mutilations are speedily repaired, and the Hydra appears to be more productive near the mutilated parts, and the segments into which any Hydra has been divided speedily become complete Hydra themselves. The earlier investigators of the Hydra, Trembley, Barker, and others, have left on record very remarkable accounts of their experiments, which about the middle of the eighteenth century excited great interest. The modes of reproduction are by ova, and by budding: the latter mode generally occurs in warm weather. Hydra, similar in all respects to their parent, seem to sprout from its side, and perhaps themselves to bud, so that three generations of Hydra may be seen attached together. There are three species of Hydra, one of which *Hydra viridis* is green, and the other two of which *Hydra fusca* and *Hydra vulgaris* are brown. Related to the Hydra are the Sertulariæ, often found attached to sea-weeds and rocks, a number of which were described by the lecturer. Many of the Medusæ, or Jelly-fish, are believed to be transition stages of Hydra, and in one case, that of *Chrysaora hysocilli*, the complete life history has been traced, and is a most remarkable one, every different stage being of such a character as to induce an observer to believe it a separate animal. The Zoophytes have been objects of study for centuries, but until 1599 were believed to be either plants or inanimate objects, the advocates of the latter opinion holding that the polyps. were simple evidences of fluorescence or crystallization. In 1599, Ferank Imperato, a native of Florence, claimed the Zoophytes as animals. He was followed later by Pegsonnel, in 1727. The Hydra having meanwhile been discovered by Leeuwenhoek. The animal theory was received with ridicule until 1741. Trembley's experiments, backed up by the opinion of Reaumur and others,

induced it to be favourably regarded, and from 1754 it may be said to have prevailed, although Linnæus treated the Zoophytes as animal plants, or plants growing by animal flowers.

The only fresh-water Cœlenterata are the Hydra and the *Cordylophora lacustris*, which was fully described by the lecturer. In conclusion, it was stated that although to microscopists it was no new lesson to find beautiful and instructive objects in the most lowly and minute forms, not the least interesting and worthy of attention were those to which reference had been made.

After the lecture, a number of living organisms illustrative of the paper were exhibited, including *S. pumilla*, *C. squamata*, *T. indivisa*, *Coryne inflata*, *H. viridis*, and *H. vulgaris*, and mounted specimens of a number of Sertularia were also shewn. The meeting then resolved itself into the usual conversazione.

LIVERPOOL MICROSCOPICAL SOCIETY.—The Eighth Meeting of the 13th Session was held at the Royal Institution, Colquitt Street, on Friday, the 4th of November. The paper of the evening was read by the Rev. Henry H. Higgins, M.A., on the "Sea-Lily, Pentacrinus," of which the following is a digest:—

The meridian of the Sea-Lilies, Pentacrini, seems to have been reached in the seas of the mountain limestone, where they covered thousands of square miles, and became constituents of sedimentary rocks many hundreds of feet in thickness. Their extreme beauty and complexity of structure, if attained by natural selection, points to a pedigree of immeasurable antiquity, concerning which nothing is known. The Sea-Lilies have been placed near the Polypes, but the latter are radiate in type, the former are annuloid: the latter have a good canal open to, or constituting, the body cavity: the former have a distinct good canal with oral and anal apertures: the latter have no neural regions: the former have a nervous system branching from a ring with pseudo-ganglia, the latter have thread-cells: the former are without thread-cells: the latter generally are composite: the former are always simple. The annuloid structure of the Sea-Lily has nothing whatever to do with the "ringed" appearance of the stem. The segments, which are five in number, are "ringed" in a horizontal plane like the figures on the dial of a watch laid on a table. This is true of all the Echinodermata. The Star-Fish is therefore *not* a rayed animal. From an example of a "mend" in a fragment from the plume of a Sea-Lily, the subject of the restoration of lost parts, led to the following remarks. How a speck of "plasma" having from its position a special junction can take upon itself to change that junction, and charge itself with the duties attached to a fertilized ovum; at the same time having its embryological potency—modified so as exactly to suit the special requirements of a situation determined by an accident—is an enquiry from the threshold of which he that assumes to be scientifically rich must be sent empty away. It is, however, in the regions of the unknown that the noblest rewards of future observers lie hidden. Whether the highest prize may be the discovery of truth, or the habit of mind developed in the search after it—one thing is sure—nature is a field where honest toil never terminates in disappointment.

At the conclusion of which the meeting resolved itself into a Conversazione, when the following subjects were illustrated:—

Anacharis, in decay—with high power............George F. Chantrell.
Cabinet slides, recent..Alfred Leicester.
Cristatella mucedo..A. T. Smith, Jun.
Desmids and Diatoms....................................George F. Healey.
Diatoms...T. W. Bruce.
Diorite, section..Henry C. Beasley.
Diptera, species of.......................................W. H. Weightman.
Foraminifera, various.....................................I. C. Thompson.

Hairs of various animals..H. R. Boult.
Hydra viridis........................ ....Dr. McClelland.
Ova of Planorbis, showing rotation.....................J. T. N. Thomas.
Ovum of Hydra, in amœboid state..................George F. Chantrell.
Rotatoria.—*Stephanoceros*, *Floscularia*, and *Melicerta*..Chas. Botterill.
Seeds of Digitalis...Thomas C. Ryley.
Worms from wine corks......................................H. M. Bennett.

MANCHESTER CRYPTOGAMIC SOCIETY.—Mr. Thomas Brittain presided over the meeting of the Manchester Cryptogamic Society, held on Monday, October 17th, and gave a brief account of his recent visit to Cornwall, where he met Mr. Ralfs, Mr. Curnow, and Mr. Marquand, an eminent trio of Cryptogamic botanists, who reside in the vicinity of Penzance, and with whom he made several rambles in the more immediate localities, and who made his visit pleasant by social intercourse in the evenings.

Mr. Brittain had collected a large number of microscopic fungi and a few lichens, and some of these he kindly distributed at the meeting.

Mr. James Cash had also recently returned from a visit to Scotland and exhibited some of his finds, amongst them being *Orthothecium rufescens* from the vicinity of Loch Fyne, *Ulota Ludwigii* from trees near Inverary, and *Dicranum Scotianum* from Loch Reden in Argyleshire; these were in excellent fruiting condition.

Mr. W. H. Pearson exhibited *Riccia crystallina* from Suffolk, and *Jungermannia Pearsoni* (Spruce), which latter had been collected last June in Westmoreland by Mr. Stabler, this being the second recorded station for this new species.

Mr. T. Rogers exhibited a number of foreign mosses and hepaticæ from the collection made by Edward and William Hobson, who were once active Manchester botanists and members of the old Banksian Natural History Society.

The time of the meeting was fully occupied, and very pleasantly spent.

MANCHESTER MICROSCOPICAL SOCIETY.—The ordinary meeting of the Manchester Microscopical Society was held on Tuesday, October 6th, at the Mechanics' Institution, Mr. George E. Davis, F.R.M.S., one of the Vice-Presidents, in the chair. There was a large gathering of members.

M. W. Blackburn read a paper on the *Ephemeridæ*, or May-Flies, an abstract of which appears in these pages for the present month. The paper, which was of considerable length, was illustrated by numerous drawings and some specimens, mounted for the microscope, prepared by the author. The Chairman complimented the reader on the masterly manner in which the subject had been treated, and a hearty vote of thanks was accorded him.

Mr. H. C. Chadwick exhibited the results of a series of attempts to mount *Euglena viridis* as a permanent slide. They were mounted in very shallow cells made with brown cement, and had been treated with a one per cent. solution of osmic acid, as recommended by Mr. Saville Kent. After being exposed to the diffused light in a room for nearly three weeks, the specimens were found to be stained by the acid, the original brilliant green colour having almost disappeared.

Mr. Thomas Brittain had sent from Falmouth specimens of *Phragmidium bulbosum* for distribution among the members, and Mr. Doherty distributed a quantity of *Volvox globator*. Mr. Aylward exhibited a convenient microscopic mounting cabinet, into which was fitted a mounting microscope, spirit lamp, section cutter, turntable, and a set of dissecting instruments. In addition there was the usual assortment of varnishes and cements, together with a supply of slips and cover glasses. All these were conveniently arranged, so as to be ready for use at any time. By simply opening the lid of the cabinet there is a

table ready to work on, and the whole can be put away in an equally short space of time. During the evening the following objects were exhibited ;—

Diatoms, various (Wray's one-sixth)	Mr. Alston.
Larvæ of the Ephemeridæ and their cast skins	Mr. Blackburn.
Section of Human Tongue	Mr. A. J. Doherty.
,, Eye of Stickleback	Mr. Dunkerley.
,, Jaw Bone of Kitten (vertical)	Mr. Dunkerley.
,, Human Jaw	Mr. Dunkerley.
Proboscis of Fly	Mr. Lofthouse.
Lice from Slug	Mr. Mestayer.
Hydra viridis	Mr. Mestayer.
Marine Algæ in fruit	Mr, Miles.
Transverse section of crystalline lens of Human Eye	Mr. Napper.
Parasite Diatoms on Marine Algæ	Mr. Stanley.
Curly-leaved Scale Moss	Mr. Stanley.

MANCHESTER MICROSCOPICAL SOCIETY.—At the last meeting of the Society, held on Nov. 3rd, the President (Mr. John Boyd) stated that satisfactory arrangements having been made for the issue and receiving of books, members would now be asked for donations towards the purchase of books for the circulating library. A proof copy of a new work on Practical Microscopy, by Mr. George E. Davis, F.R.M.S., one of the vice-presidents, was submitted for inspection. Mr. Thomas Brittain, vice-president, distributed *Puccinia malvacearum*, and Mr. Hay, of the Salford Royal Hospital, samples of the various starches.

Mr. Herbert C. Chadwick read a short communication on *Anthophysa vegetans*, specimens of which he had found in a pond at Eccles. This infusorian, which belongs to the family Dendromonadidæ, consists of a dark brownish branching stem, to the free ends of which animalcules are attached in clusters, numbering from fifteen or twenty to as many as fifty or sixty individuals. The stem is built up of particles of food, from which the nutritive portion has been extracted by the monads in passing them through their bodies, each monad contributing its share, and this gives rise to the striated structure seen in some specimens. A short length of the stem, below the point of union with the clusters of monads, is often very soft and flexible, and the clusters may be seen to spin round at a rapid rate and in one direction for many minutes, in response to the vibrations of the long and extremely fine flagella with which the monads are provided. Each monad or zooid possesses a nucleus and two or three contractile vesicles. Occasionally the clusters may be seen detached from the stem, and swimming freely. Mr. Chadwick stated that he had repeated with some success an experiment made by Mr. Saville Kent, and described by him in his Manual of the Infusoria. This was performed by feeding the animalcules with carmine or indigo. The particles of colouring matter were quickly ingested, and were soon to be seen scattered about in the newly-formed part of the stem, having been passed into it through the posterior extremity or point of union with the pedicle of each monad. Associated with *Anthophysa vegetans* were some very fine specimens of *Carchesium* (or *Epistylis*), and a curious organism named *Phacus longicaudus*, the form of which strongly resembles a three-bladed screw.

Mr. John Smith, M.R.C.S., of Chorlton-road, followed with a paper on the Life History of *Cysticercus cellulosæ*. In the course of the paper, Mr. Smith said the meat measle had been known from time immemorial, the Mosaic injunction to abstain from eating swine's flesh being probably founded on a knowledge of the mischievous effects of Cysticercus and Trichinæ on man, and was one of the many wonderful hygienic rules contained in the Levitical law. The pork measle was mentioned in one of the Greek plays of Aristophanes. A learned physician had said that man was aptly defined as the cooking animal,

for he alone among animals cooked his food. In perfect cooking lay the true preventative remedy, because if the measle were destroyed the perfect animal or Teniæ would cease to exist, and it had been found that a temperature as low as 140° F. was sufficient to destroy the meat measle.

Mr. Edward Ward, F.R.M.S., read some notes on Micro-crystallization, which dealt with the various processes of obtaining slides of different salts, and combinations of them. The modes of obtaining the various crystalline preparations from tartaric acid, gallic acid, pyrogallic, hippuric, and citric acids were fully explained, detailing how large and small crystals could be formed, as well as the wheel and floral forms. The mode of dealing with the various salts of soda and potash and their combinations followed.

Mr. George E. Davis, in a few pertinent remarks on the practical study of Micro-crystallography, instanced how readily now-a-days the microscope could be brought into use for the solution of many technical difficulties.

The papers were listened to with great attention, and votes of thanks were heartily accorded to the several readers.

The display which followed was unusually good. Mr. Davis brought before the notice of the members a new form of stand by Ross, having a sensitive fine adjustment; and also a diaphragm made for him by Messrs. Ross & Co., to cut down the apertures of objectives when "penetration" is required. [This will be described in our next issue.—Ed.] Mr. E. B. Cook showed a remarkably clean gathering of desmids and diatoms, in which *Closterium lunula, C. striolatum*, and *Micrasterias denticulata* were abumdant. Mr. Aylward exhibited a most carefully prepared series of starches *in situ* by the aid of polarized light; Mr. H. C. Chadwick, living specimens of *Anthophysa vegetans* and polyps of *Alcyonium digitatum*, showing extended tentacles and spicula *in situ;* Mr. A. H. Doherty, the cellular tissue of the rush and sugar-cane; and Mr. J. L. Miles, vertical sections of the cat's lip and tongue injected and stained. The slides illustrating Mr. John Smith's paper were valuable, and extraordinary care had been taken in their preparation.

MANCHESTER NATURAL HISTORY SOCIETY.—At the last meeting of the Lower Mosley-street Society, held on Monday evening the 14th inst., a variety of interesting objects were exhibited by the members. Mr. Charles J. Wild showed a fine collection of mosses, many of which were rare, and amongst them were representatives of the genera Campylopus, Dicranella, Dicranium, Gymnostomum, Andræa, Phascum, and Cynodontium. Mr. Thos. Brittain showed over a hundred leaves of various plants which displayed in a remarkable manner the tints of autumn, such as red, brown, yellow, black, and green. In some of the specimens these colours were distinct and very conspicuous, but in others they were beautifully blended together. An extraordinary slide for the microscope was exhibited, which had upon it fifty species of Foraminifera arranged in groups, the name of each underneath having been photographed, so as to occupy little space. Some living Ferns were shown by Mr. Thomas Rogers, a fossilized plant by Mr. R. Graham, and some fish scales by Mr. H. Hyde.

NOTES AND QUERIES.

The "Congress" Turntable.—The "Congress" Turntable, invented and first exhibited by Mr. Sidle at the "Congress of Microscopists," held at Indianapolis, may be thus briefly described:

Into the upper surface of the rotating plate, diametrically op-

posite and equidistant from the centre, two circular plates or discs, one inch in diameter, are set, their surfaces flush with that of the large plate. Pivots from the two discs project through the plate, and each carries upon the lower side of the plate a toothed wheel. A hollow sleeve, rotating free from the stem of the table, carries a third and larger wheel, which gears into the two others, and thereby gives rotation to the discs in the top of the plate.

Near the opposite edges of the two discs, the angular jaws which hold opposite corners of the slide are pivoted (as in Cox's and other forms of tables), and it will be seen that by giving rotation to the central wheel, under the plate, the jaws may be made to approach or recede at pleasure.

A coiled steel spring, concealed within the hollow sleeves serves to close the jaws, while the single motion of a milled head upon the sleeve opens them to their full extent.

It will also be found, that although the jaws do not approach in a straight line, yet, when properly adjusted, a line joining the pivots of the jaws will cut the centre of the plate, whatever the position of the jaws; and they being always equidistant from the centre, it follows that the slide, when clasped between them, must be perfectly centered.

For the purpose of re-touching old slides, the ordinary clip-springs are retained.

The price of this Turntable is six-and-a-half dollars, or equal to twenty-seven shillings of our money.

INFUSORIA.—We have lately received some interesting tubes from Mr. Bolton, one of which, containing a sprig of *Myriophyllum spicatum*, was exceedingly rich in organisms. We found *Melicerta ringens*, *Limnias ceratophylli*, *Floscularia cornuta*, *Philodina megalstricha*, together with many species of Vorticellidæ.

The weed was culled from a river pool near Stourbridge, yet it contained the reputed brackish-water diatom *Bacillaria paradoxa*.

There were also many Choano-Flagellate monads attached to the weeds and to the various organisms.

GLYCERINE MOUNTS.—I have had much bitter experience with preparations mounted in glycerine, which suffer injury from clumsiness in handling, more than the fault of expansion; for after a preparation has been mounted two or three years, the cement becomes very hard, and if injured by a fall, or knock against the microscope, starts a leak. The number of preparations ruined by my customers in this and other ways, prompted me to find a remedy, or to lesson the chance of injury. I have now devised the metal caps, which so far have stood the heavy thumps of the Post-office men, and all the clumsy treatment which many give them. The caps are made to fit Pumphrey's vulcanite cells, as

they are the only cell to be depended upon for size and shape. I never use any other. My plan of using these caps is as follows:—After having fixed the cover properly and without leakage, I wash the preparation under the tap until all traces of glycerine are removed, then run a good thick ring of any kind of cement round the edge of the cover and cell, finally dropping on the cap, when the mount should be placed aside for a week, so that the cement or varnish may properly set. I use these caps for all deep cells, as they prevent the cover from being pushed off, and am having some made half the depth of those sent, for shallow cells.—*Fred. Enock.*

[We are glad to find Mr. Enock doing something to improve the condition of glycerine mounts. The caps he has sent us will certainly do much to prevent leakage and disappointment. They are made to fit Pumphrey's vulcanite cells of $\frac{7}{8}''$, $\frac{3}{4}''$, $\frac{5}{8}''$, and $\frac{1}{2}''$ diameters, and are sold at the moderate price of threepence per dozen.—ED.]

FRESH-WATER SPONGE.—A short time ago I had the pleasure of communicating to S. G. the occurrence of *Daphnia Bairdii* and *Diaptomous castor* in this locality. Since then I have found a Sponge, which seems to differ slightly from the ordinary *Spongilla fluviatilis.* One of the specimens was over three inches square, which so far as I know is a very unusual size. Hogg states that the gemmules of Spongilla have a skeleton of bi-rotulate spicula. I have not been able to detect any spicula coating the gemmules even when treated with acetic acid. These two points, large size and absence of spicula in the gemmules, lead me to think it may possibly be new.—*J. E. Lord.*

CHAS. A. SPENCER, the celebrated American objective manufacturer, is dead. He died at his residence in Geneva, N. Y., on the 28th of September last. He was born at Canastota, N. Y., in the year 1813, and was educated at the Cazenovia Academy, from which he graduated. He afterwards spent one year at Hobart College. During the past few years he did little more than superintend the labor of his sons, and perhaps the latest productions of his factory were mainly due to the abilities of his son Herbert, who now carries on the manufacture, under the title of Herbert R. Spencer and Co.

AQUARIA.—Could any of your readers tell me how often it is necessary to clean out an aquarium, and how many fish, snails, and weeds are necessary?—*Tom Brown.*

KEEPING RAULIN'S FLUID.—Both Pasteur's and Raulin's fluids are very difficult to keep. They are so extremely sensitive that the simple exposure of the fluids to air for two or three days (in a town) is sufficient to convert the whole into a ropy mass of

mycelium. Then, again, starch solution is not easy to keep for any length of time. Chemists have, it is true. succeeded somewhat by the application of salt, chloride of calcium, and other antiseptics; but these more or less interfere with the universal application of starch solution, and could not be used at all with either Pasteur's or Raulin's fluid.

Two years ago, the writer devised a plan for keeping such fluids as are above-mentioned, and with the result that the remainder of a litre of Raulin's fluid made up in November, 1878, is now as good as when first mixed. The illustration, Fig. 62, shows the construction of the apparatus :—

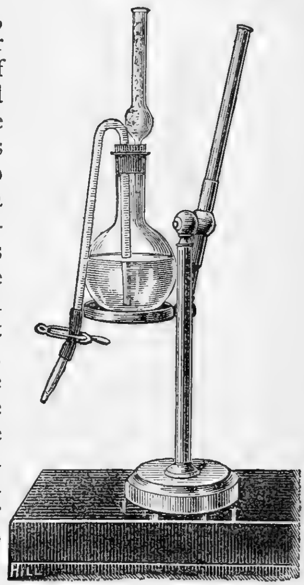

Fig. 62.

It consists of an ordinary glass flask, fitted with an indiarubber stopper pierced with two holes, into one of which is tightly inserted a tube, packed with clean cotton wool. Into the other hole, the shorter limb of a glass syphon is inserted, the longer limb being closed with a spring clip upon a short length of rubber-tubing, in advance of which is a narrow glass jet, as shown in the figure. To put the apparatus in working order, nearly fill the flask with the fluid, and take out the cotton wool from the tube above, place over a lamp to boil, and while boiling open the clip and stop up the open end of the wool tube, so that the pressure may drive some of the liquid out of the flask. Return this ejected fluid to the flask, and keep boiling for five minutes, allowing the steam to escape from the open wool-tube. While steam is thus escaping, place a plug about half an inch in depth of cotton wool, and allow the steam to blow well through it. After one minute plug the whole of the tube with cotton wool, and withdraw the flame. By simply opening the clip a supply may now be withdrawn, without the introduction of any atmospheric germs into the flask.

NOTICES TO CORRESPONDENTS.

All communications should be addressed to the Editor, Mr. George E. Davis, Dagmar Villa, Heaton Chapel, Stockport; and matter intended for publication must reach us not later than the 14th of the month.

All communications must be accompanied by the name and address of the writers, not necessarily for publication, but as a guarantee of good faith. Cheques and money orders to be made payable to George E. Davis, the latter at the Manchester Chief Office.

C. C. C. (Northampton).—We cannot undertake to do more in the way of testing objectives than we are doing.

J. A. R. (Wilts).—We shall be very happy to tell you which of the two glasses are the best, subject to the conditions of our Verification Department.

W. L. W. E. (Hants).—Can you send us more of the fungi in a pill-box; they get so dry, dirty, and smashed up in a letter.

F. E.—Cells received with caps for them. They are very good.

W. P. C. (London).—We do not think it is very likely we shall reprint No. 1 unless a sufficient number of subscribers are got beforehand.

A. A. (Windsor).—One of the conditions of our Verification Department is that all measurements shall be inserted in the Journal.

T. P. S. (Facit).—Thanks for the No. 1; they are always acceptable now.

J. G. (Northampton).—We shall be glad to hear from you upon the subjects you mention.

EXCHANGE COLUMN FOR SLIDES AND RAW MATERIAL.

Communications not exceeding 24 words are inserted in this column *free*. They must reach us before the 14th of each month. Exchangers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied with a penny stamp for each letter to cover postage.

ANIMAL PARASITES.—Have a large number of these in exchange for animal parasites, ixodes and acari, mounted or unmounted. W. A. Hyslop, 22, Palmerston-place, Edinburgh.

EXCHANGE.—Wanted to exchange for a good microscope, my collection of carboniferous, &c., fossils. List on application to George Ward, 10, Friar-lane, Leicester.

GENERAL SLIDES in exchange for others. C. D., Care of Editor.

SALE COLUMN FOR APPARATUS, BOOKS, ETC.

Advertisements in this column are inserted at the rate 4d. for each 12 words or portions of twelve.

Advertisers may adopt a *nom-de-plume* under care of the Editor, but in this case all replies must be accompanied by a penny stamp for each letter, to cover postage.

All Advertisements intended for insertion in this column must reach us before the 14th of each month.

MICRO-SPECTROSCOPE by Browning, scarcely ever used. Quite equal to new, in Mahogany case, cost £9, price £7, or should be glad of offers. A. L., Care of Editor.

FOR EXCHANGE.—A good one-fifteenth immersion objective by Dancer for sale or exchange. Wanted (1) Heliostat, (2) Swift's best lamp and goniometer eye-piece, (3) Ramsden's eye-piece Screw micrometer, or what offers. Address J., Care of Editor.

MICROSCOPE for sale or exchange. A good binocular microscope by Browning, nearly as good as new, in mahogany cabinet with box for apparatus. It has mechanical stage; stop to ditto to use Maltwood's finder; a pair of A eye-pieces; a pair of B and a single D, Selenite stage; Morris' rotating stage; Achromatic condenser, Polariscope, Camera Lucida and Bulls'-eye condenser. Price £14, or would exchange for a wide angle one-sixteenth, by Powell and Lealand, or a set of the Quarterly Journal of Microscopical Science. B., Care of Editor.

POLYZOA.—Named slides of British and Foreign Polyzoa at six shillings and eight shillings per dozen respectively. J. C. E., Care of the Editor.

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